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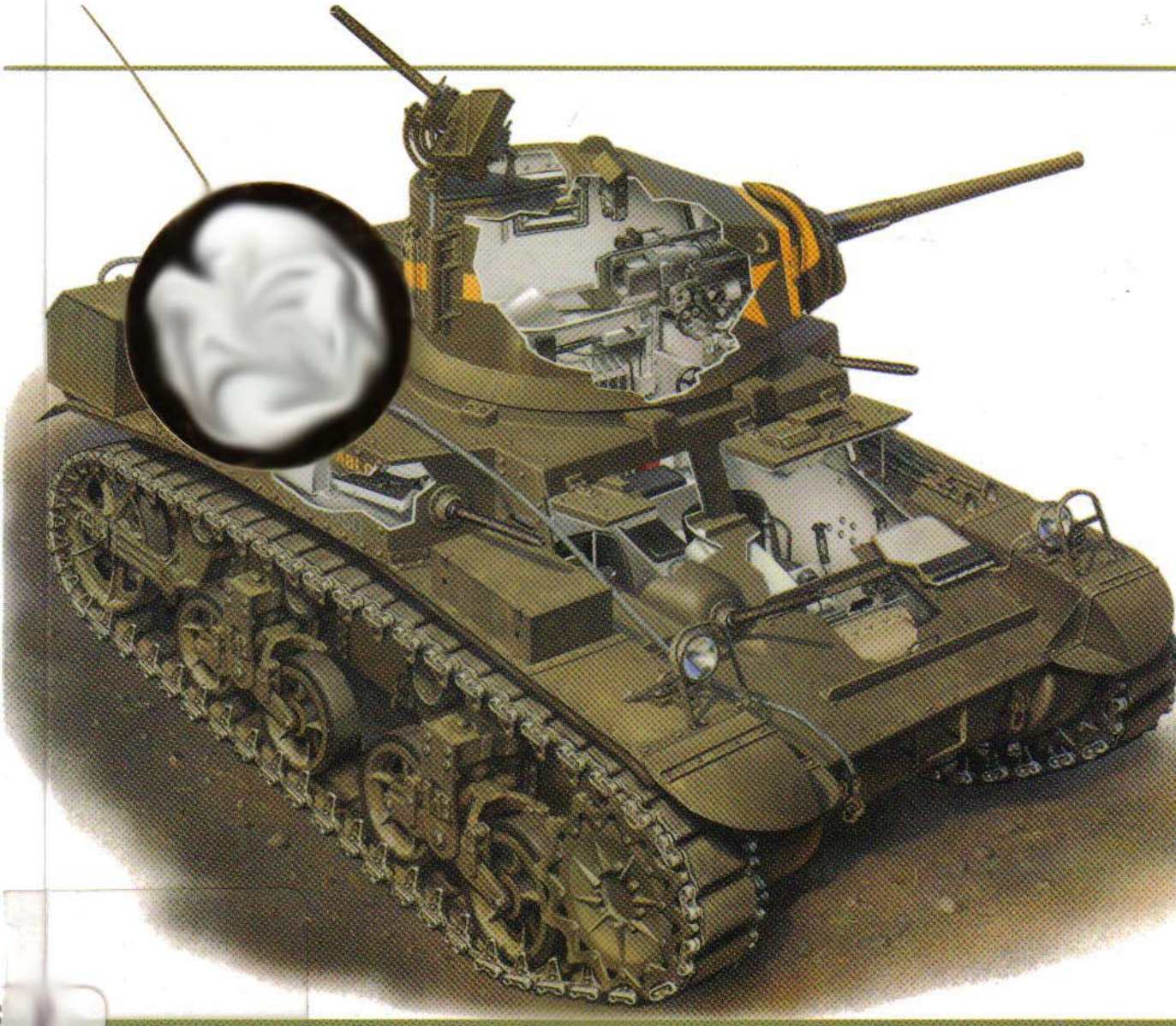
M3 & M5 Stuart Light Tank 1940–45



Steven J Zaloga • Illustrated by Jim Laurier

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New Vanguard • 33

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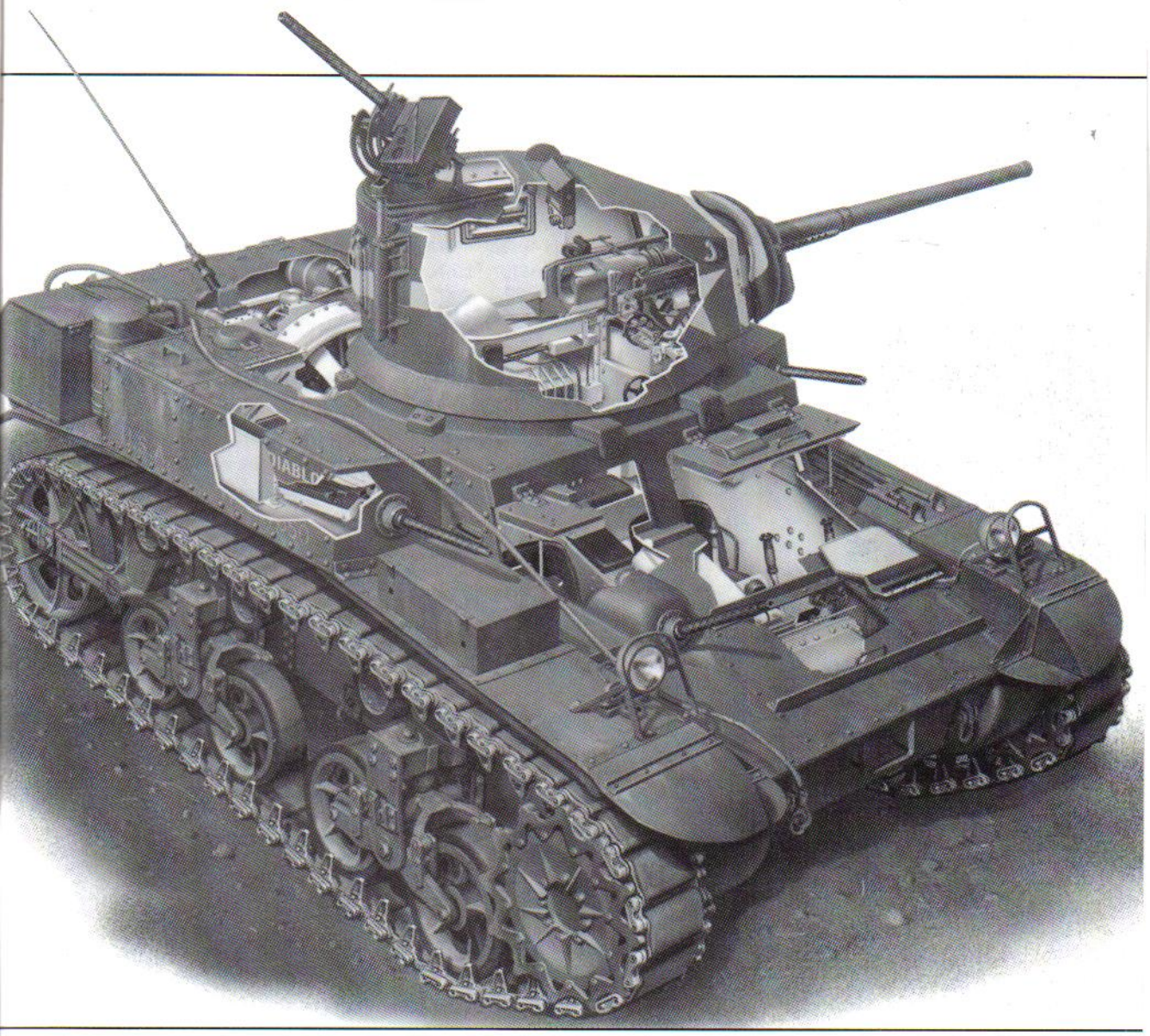

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First published in Great Britain in 1999 by Osprey Publishing,
Elms Court, Chapel Way, Botley, Oxford OX2 9LP
Email: info@ospreypublishing.com

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ISBN 1 85532 911 5

Military Editor: Marcus Cowper
Design: Chris @ D4Design

Origination by Valhaven Ltd, Isleworth, UK
Printed in China through World Print Ltd.

02 03 10 9 8 7 6 5 4 3 2

FOR A CATALOGUE OF ALL BOOKS PUBLISHED BY
OSPREY MILITARY AND AVIATION PLEASE CONTACT:

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29 Prospect Avenue, Osceola, WI 54020, USA.
Email: info@ospreydirectusa.com

www.ospreypublishing.com

Author's note

The official ordnance nomenclature for US military equipment follows the pattern of 'Light Tank, M3' or the quartermaster nomenclature style of 'Tank, Light, M3'. In this book, the more readable form used by the Armored Force is used, such as 'M3 light tank'. Unlike the British and German armies, the US Army did not take great pains to distinguish sub-variants of their tanks. For example, the M3 light tank series was fitted with no fewer than four different turrets, but all four versions had the same nomenclature, M3 light tank. As a result, an effort has been made here to use other wartime nomenclature for key distinguishing components such as turrets, which may be unfamiliar to most readers as it is different from current practices. This system was based on the engineering drawing number, and was used as a parts reference in wartime ordnance standard nomenclature lists. As in any book of this size, it is impossible to cover the dozens, if not hundreds of sub-variants, proposed designs and other variations of this large tank family. The effort here is to concentrate on those types which actually saw combat use.

The author is indebted to many people for their help with this project. The author would like to thank Tom Jentz, Jeff McKaughan, and Peter Brown who provided archival material from their own research. Thanks also to Charles Lemons, John Purdy and Candace Fuller of the Patton Museum at Fort Knox, Kentucky, for their help in examining preserved M3 and M5 light tanks in their excellent collection, as well as for access to their superb archive. Likewise to David Fletcher and the Tank Museum at Bovington. Thanks also go to the staff of the library, archive and special collection branch of the US Army Military History Institute at the US Army War College, Carlisle Barracks, Pennsylvania, and the US National Archives, and to Ed Kaminski of ACF Inc. for help with photos and other documentation from the American Car & Foundry archives.

Artist's note

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M3 & M5 STUART LIGHT TANK 1940 – 45

INTRODUCTION

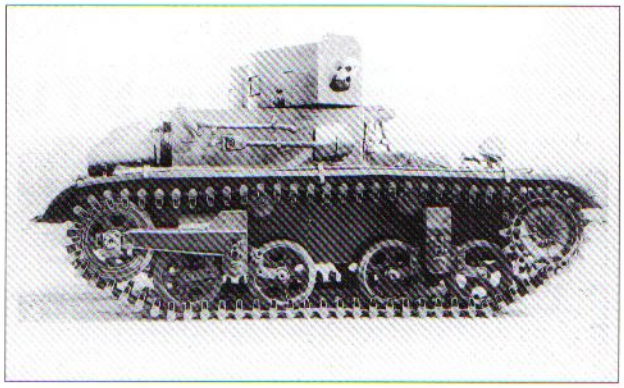
The M3 and M5 family of light tanks were the culmination of American tank development of the 1930s. By the time of the outbreak of the Second World War, they were approaching obsolescence, as tank forces in Europe were shifting from light to medium tanks as the main element of their armored forces. First entering combat in the autumn of 1941 in the Western Desert with the British Army, the Stuart quickly showed that it was inadequate in tank fighting. The same story was repeated a year later when the US Army confronted the Afrikakorps in Tunisia. But the Stuart tank was available in such large numbers that rather than withdrawing it, it was moved to secondary missions such as reconnaissance. The M3 and M5 light tanks proved more suitable in the Pacific theater than in Europe, and fought successfully in many of the major battles including Guadalcanal, Tarawa, Peleliu, Saipan and Burma. They were quickly retired from service by the major armies after the Second World War. But their automotive soundness served them well, and they lingered on in regions outside the mainstream of military development, forming the core of some South American tank forces well into the 1980s.

The Stuart family is best remembered for its role in the desert fighting in North Africa in 1941 and 1942. Popularly called the 'Honey' for its pleasant driving characteristics, it equipped the 4th Armoured Brigade of the 7th Armoured Division during Operation *Crusader* in November 1941. This is a classic view of Honeys of the 8th King's Royal Irish Hussars on training in Egypt before the battle.
(The Tank Museum)

Combat Car and Light Tank

Following the First World War, the US Army's short-lived Tank Corps was subordinated to the infantry branch. Given the prevalent isolationist sentiment in Congress, US doctrine was based on the premise that the US was unlikely to fight in a European war again. Military operations in the Philippines or along the US border were considered more likely scenarios, and tanks were not viewed as important to such missions. The combination of low priority and the parsimonious US inter-war defense budget meant that US tank development labored under minuscule budgets. Although the infantry was responsible for tank

development, the cavalry's role as the army's mobile force inevitably led to interest in tanks as a substitute for horses. In the 1930s, a peculiar situation arose under which the infantry fostered the development of 'light tanks' as the infantry tanks were called, while the cavalry funded 'combat cars', since they were legally prevented from acquiring tanks. This situation was all the more farcical as the design of both types of vehicles shared a number of features and they were both designed and manufactured at the army's Rock Island Arsenal in Illinois.



The original ancestor of the Stuart family was the T5 Combat Car developed for the US Cavalry at the Rock Island Arsenal in 1934. It shows many of the features that would become characteristic of the Stuart light tanks, notably the hull design and the vertical volute suspension bogies. ***(US Army MHI)***

The most influential tank design of the inter-war years was the British Vickers six-ton export tank. After obtaining a Vickers tank for trials, a rough analogue, the T1E4 light tank, was developed and tested. In the meantime, the cavalry branch had been experimenting with alternative designs including the T1 combat car, better known as the Christie tank. In early 1933, the Secretary of War ordered that future combat cars and light tanks be limited to a maximum weight of seven-and-a-half tons. Based on the new directive and other design requirements from the army, the Rock Island Arsenal completed the T2 light tank and T5 combat car in 1934. With a number of common features, they were the direct ancestors of the M3 light tank. The T5 combat car was substantially redesigned before series production was undertaken from 1935 to 1937 as the M1 combat car. These tanks were armed with a .50cal. heavy machine-gun, a separate .30cal. machine-gun in a single turret, and a .30cal. machine-gun in the hull. In the mid-1930s, the US Army considered the .50cal. heavy machine-gun to be an effective anti-tank weapon, since it could penetrate the armor of most foreign tanks of the period. The M1 combat car also evolved during production, with a new slab-sided turret on later production vehicles.

The US Army was still not very clear on what was needed in a tank in the mid-1930s. In parallel to the turreted T5 combat, the T5E1 combat car was built with its machine-gun armament in a barbette configuration. This was essentially a mobile pillbox, with machine-guns bristling in all directions. This design was eventually dropped in favor of more conventional turreted weapons. ***(Patton Museum)***

Alongside the cavalry's efforts, the infantry's T2 light tank entered production in 1935 as the M2A1 light tank. The hull bore a strong resemblance to the M1 combat car, but the M2A1 light tank was fitted with a smaller, one-man turret with a .50cal. heavy machine-gun. After only ten were produced, the infantry switched to twin-turreted tanks on the presumption that such a configuration would have more combat value for infantry support, since the turrets could independently direct fire at two targets simultaneously. The twin-turreted M2A2 light tank was produced in 1935–7 and was by far the most common version in the 1930s.

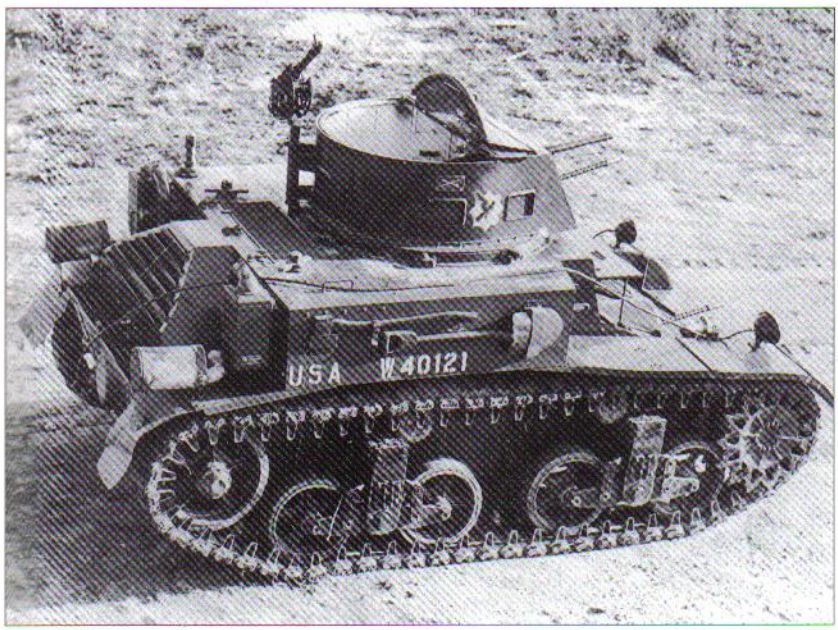
Lessons of the Spanish Civil War

The first major tank combat since the First World War took place during the Spanish Civil War which began in the autumn of 1936. Most of the tank fighting occurred in 1937, when the Soviet T-26 light tank of the Republican forces was pitted against the

machine-gun-armed German PzKpfw I and Italian CV.3/35 light tanks of the Nationalist forces. The reports of US Army attachés in Spain made it clear that the cannon-armed T-26 was clearly superior to the machine-gun-armed tanks. The dominant lesson was the vulnerability of light tanks to anti-tank weapons such as the German 37mm gun. These lessons were of considerable interest to the US Army, as US light tanks and cavalry cars were based on the Vickers six-ton tank, which also formed the inspiration for the Soviet T-26. Studies in 1938 concluded that future US tanks should be armed at least with a 37mm gun, and that the vehicle armor had to be increased from the existing level of ⅝ inch (16mm) as this could be easily penetrated by a 37mm gun from any realistic combat range.

As a short-term expedient, the existing light tanks could be modestly upgraded. However, incorporation of enough armor to defend against a 37mm anti-tank gun would require a much more elaborate effort. The infantry's new M2A3 light tank entered production in 1938 having benefited from some of these lessons. The hull was lengthened and suspension bogies spaced further apart to accommodate the heavier armor, with the frontal armor increasing from 16mm to 22mm. A modified engine, the Continental W670-9, was introduced and there were numerous other improvements. Most of these features were incorporated into the cavalry's parallel M1A1 combat car which also entered production in 1938. While the Spanish Civil War was the catalyst for the US Army's development of new medium tanks, it did not provoke any serious questions about the viability of light tanks on the modern battlefield. This would not have mattered, as defense budgets in 1938–40 would not permit the complete transition of the army from light tanks to medium tanks. However, the shift to medium tanks was well underway in Europe, most notably in the Soviet Union, France, and Germany.

The cavalry branch largely ignored the Spanish Civil War lessons and its 1940 production plan focused on the M2 combat car, still armed with a .50cal. machine-gun. In December 1938, however, the infantry authorized the construction of the improved M2A4 light tank, fitted with a single large turret with a 37mm gun, and protected with thicker 1in. (25mm) armor. Other important improvements included the incorporation of radio receivers in all tanks, and radio trans-mitters in command tanks. By the time the M2A4 light tank was ready for production in May 1940, war had broken out in Europe. The US government recognized that its isolationist foreign



The M1 Combat Car was the first production version of the series for the US Cavalry. The original production vehicles used a round turret as seen here, with a .50cal. heavy machine-gun and a .30cal. machine-gun in independent mountings. This is a vehicle from the 1st Cavalry, evident from its unit crest which traces its lineage back to the Black Hawk Wars. ***(Patton Museum)***

policy was likely to change, and with it the need for a substantially enlarged and modernized US Army. As a result, tank production was shifted from the small government arsenals to larger commercial plants to permit a surge in production if war broke out. M2A4 light tank production began at the well-known railroad manufacturer, American Car & Foundry in Berwick, Pennsylvania, in May 1940.

Following the shock of France's defeat in June 1940, the US Army decided to expand its tank units and a new Armored Force was created on 10 July 1940, consolidating the cavalry combat cars and infantry light tanks under a single command. The M1 and M1A1 combat cars were redesignated as the M1A2 light tank, and the M2 combat car became the M1A1 light tank. The fall of France forced the US Army to recognize its backwardness in armored vehicles. Instead of low intensity colonial or border conflicts, it was growing likely that it would face a high intensity conflict in Europe. The US Army responded by forming its first armored divisions in the summer of 1940 which would need modern medium tanks, but until US industry was ready to manufacture medium tanks, light tanks would have to suffice.

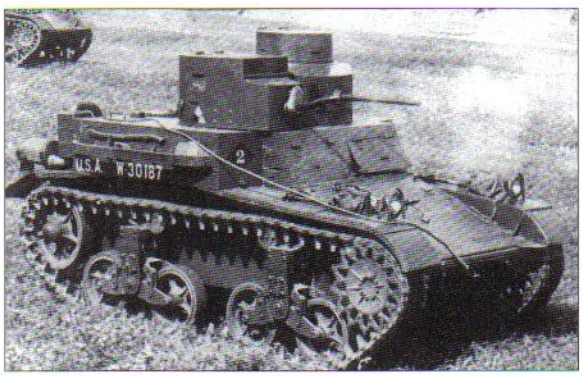
THE M3 LIGHT TANK

Although the M2A4 light tank was a substantial improvement over the previous light tanks and combat cars, it had technical and design problems. Work began on the new M3 light tank in July 1940. The added weight of armor caused mobility problems on the M2A4, and was partly resolved by a shift to the enlarged rear idler of the M2 combat car which increased the area of ground contact. The long recoil mechanism of the M5 37mm gun in the M20 combination mount projected far outside the M2A4 turret, making it difficult to protect. A modified design was produced, the M5 37mm gun with a new short recoil mechanism in the M22 combination mount. Finally, the existing 1in. (25mm) armor was deemed inadequate to protect the tank from contemporary anti-tank guns, but a frontal protection of 1.5in. (38mm) of armor was all the chassis could bear even though it did not offer proof against 37mm anti-tank guns at normal combat ranges. The M3 light tank entered production at American Car & Foundry in March 1941. It was the most numerous US tank at the outbreak of the war, and would be the principal US type to see combat in the first year of the war.

The later production batches of the M1 Combat Car used a slab-sided turret instead of a round turret. This is the combat car of the commander of the 13th Cavalry, marked prominently with the white command guidon with the regimental crest in the guidon and repeated on the rear side panel.
(US National Archives)

In parallel to the cavalry's combat cars, the US infantry branch procured a separate family of light tanks sharing much in common. Only ten of the M2A1 light tanks were manufactured before production changed to a twin-turreted version, the M2A2. This M2A1 served with the 7th Tank Company, 7th Division in 1936 carrying the divisional insignia in color over the tank emblem. The tactical marking on the sponson identifies it as the fourth tank of the first platoon. As was common during training, the tank lacks its .50cal. machine-gun armament. ***(Patton Museum)***

This is an M2A2 light tank of the 28th Tank Company during summer wargames in New York state in 1940. In contrast to the M2A1 light tank, the M2A2 light tank had its armament in two separate turrets. The initial production series used rounded turrets as seen here. ***(US National Archives)***



The original production batch of 100 M3 light tanks was fitted with the D37812 riveted turret similar to that on the M2A4 light tank, but with a new pattern of pistol port. Trials had shown that heavy machine-gun fire could dislodge the interior head of the rivets, however, sending them careening around the turret interior and injuring the crew. As a result, the new D38976 welded turret, made from face-hardened armor, was authorized in December 1940 and the first tank with the new feature was completed in April 1941. The M5 37mm gun was replaced by the improved M6 37mm gun which had a tube five inches longer than the M5, and an automatic breechblock. The original M3 light tanks had the 37mm gun in the M22 combination gun mount which used a shoulder stock for elevating the gun. This was replaced by the M23 combination gun mount which used a more conventional elevation gear, an improved shell deflector and other changes.

The M3 light tank was an adequate, if uninspiring design which reflected US neglect of tank development in the years leading up to the Second World War. It was comparable or superior in terms of armor, firepower, and mobility to older European designs of the late 1930s such as the Soviet T-26, the Polish 7TP, and the Czech/German PzKpfw 38(t). However, the Spanish Civil War experience had been interpreted very differently in Europe, reinforcing a trend to larger, more heavily armored and better-armed tanks. Prior to the outbreak of the Second World War, most European armies had abandoned the light tank as the basis of their armored forces, favoring medium tanks that were larger and more than five tons heavier. In France, this produced the Somua S.35 and Char B1 bis, and in Germany the PzKpfw III and PzKpfw IV. The most radical solution was attempted in the Soviet Union, where the Spanish Civil War inspired the T-34 design which would replace both their infantry's light tanks and the cavalry's cruiser tanks. While the main influence in tank design in the 1920s and 1930s came from Britain and France, Soviet and German innovations dominated the wartime experience.

During the early war years, the US Army was strongly influenced by their more experienced British allies in tactics and technology. Unfortunately, British tanks were no longer in the forefront of design technology. A combination of a lack of maturity in US Army tactical doctrine, and a concentration on production quantity over quality, meant that US tank design consistently lagged behind Germany throughout the war. The US Army began to shift its emphasis to medium tanks in 1941 with the clumsy M3 medium tank, but medium tank production did not begin to exceed light tank production until December 1941. A truly modern medium tank, the M4A1 Sherman, did not appear until the spring of 1942. Though the M3 light tank compared badly with its European contemporaries, it fared better in

comparison to its likely rivals in the Pacific, the Japanese Type 95 Ha-go light tank and Type 97 Chi-ha medium tank.

The final production batches of the M2A2 light tank used slab-sided, welded turrets as can be seen in this overhead view of a tank on maneuvers at Fort Belvoir, Virginia, on 22 November 1940. *(US Army MHI)*

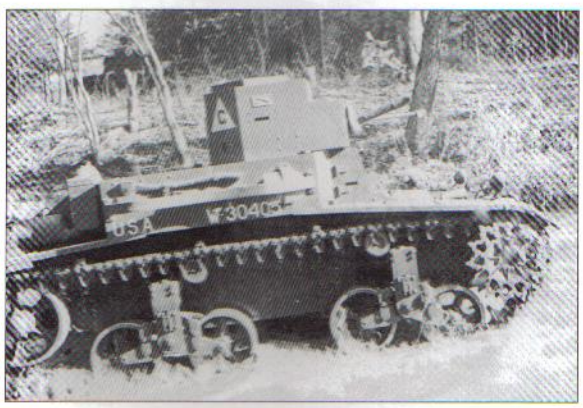
The M3 Stuart goes to war

While the United States was ostensibly neutral through 1940 and 1941, President Franklin Roosevelt was convinced that his country would eventually be dragged into the war, and took steps to prepare for this eventuality. With Britain as the lone defender against Germany and Italy, Roosevelt began to assist in arming the British forces. This culminated in the March 1941 Lend-Lease Act. British officers in the United States had little to choose from in American tanks, just the M2A4 light tank and M3 medium tank. But in the desperate circumstances of early 1941, they ordered whatever was available. The first order was for 100 M2A4 light tanks, and the first 36 arrived in June 1941; 32 were shipped to the UK and four to Egypt. The further supply of the M2A4 was halted once the improved M3 light tank became available.

The two new American tanks shared a confusing similarity in nomenclature, the M3 light tank and M3 medium tank, and so Britain instituted its own system for American tanks using the names of American Civil War generals. The M3 light tank was called the General Stuart, after the Confederate cavalry general J. E. B. Stuart, and the M3 medium tank was named the General Lee, after the legendary Robert E. Lee. To add some balance, the M3 medium tank with a new British turret became the Grant, and the new M4 medium tank became the Sherman after the two Union generals. None of these names were sanctioned by the US Army, nor were they commonly used by US troops during the war. However, the names did become popular in the United States after the war, and are still widely used.

The Stuart tank did not conform to British design or tactical concepts. Although an infantry tank by US standards, it was lightly armored compared to British infantry tanks such as the Matilda. Nor did the Stuart have the range deemed necessary for a cruiser tank, being capable of only about 75 miles on firm ground and about 45 miles in rough desert conditions. However, in technical terms it was closer to the cruiser tanks than to the infantry tanks, and so was used as such when first issued to units in the Western Desert in 1941. In terms of armament, its 37mm gun was similar to the standard British 2-pdr. in anti-armor penetration at usual combat ranges, but had the advantage of firing a high explosive round which was useful in engaging targets other than tanks such as anti-tank guns and infantry.

The effectiveness of anti-tank guns during the Spanish Civil War made it clear that more armor would be needed for tanks to survive on the battlefield. To accommodate the weight of added armor, the suspension bogies on the new M2A3 light tank were spaced further apart. This M2A3 is on exercise with the 66th Infantry (Tanks) at Fort George Meade, Maryland, on 14 November 1939. The triangular marking identifies this as a battalion headquarters tank. *(US Army MHI)*



In August 1941, a program was started to modify the Stuart to adapt it to British practices. By October 1941, the list had grown to more than 26 changes, and to further complicate matters,

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The M3 light tank saw its baptism of fire during Operation *Crusader* in Libya in late November 1941. This is Crossbow from the 3rd RTR, 7th Armoured Division, knocked out by a hit to the turret. Prior to the fighting, the division's Stuarts were fitted with 'sunshields' which were a frame assembly with cloth covering designed to make the tank look like a lorry to enemy reconnaissance aircraft. This was part of an elaborate deception scheme intended to surprise Rommel's Afrikakorps. Although most tanks had the sunshields removed, some tanks like this one left on the lower portion. *(US Army MHI)*

the modifications carried out in Middle East workshops did not coincide directly with those carried out in the UK. The most noticeable external changes were the addition of sand-shields, a water container rack, a ration box, a blanket box and a cooking set box, blanking plates over the sponson machine-gun ports, and a folding frame to make it easier to close the turret hatch while standing in the cupola. The Stuart had a total of five .30cal. machine-guns: two fixed in the hull, one flexible in the hull, one co-axial with the main gun and one on an external mounting on the turret roof. This was deemed excessive by British tank specialists. The fixed sponson machine-guns were normally deleted in favor of more internal stowage. There were extensive internal changes affecting both mechanical details and stowage. If the British tankers were a bit wary of the Stuart's unfamiliar features, they were pleased with its automotive reliability. By 1941, the Stuart was a mature design, and was more durable and dependable than the British tanks of the day, leading to its nickname of 'Honey' in the 7th Armoured Division.

Desert debut

The first large shipment of 84 Stuart tanks arrived in Egypt in July 1941. By the autumn of 1941, enough Stuarts had arrived to equip the three tank regiments of the 4th Armoured Brigade, part of the famous 'Desert Rats', the 7th Armoured Division. These units would first see combat in the November 1941 Operation *Crusader*, an attempt to re-capture Cyrenaica and relieve Tobruk. The units equipped with Stuarts were the 8th King's Royal Irish Hussars, the 3rd and the 5th Royal Tank Regiment, which had a total of 165 Stuarts on hand at the start of the operation. The 7th Armoured Division's other two brigades were equipped with cruiser tanks, Crusaders for the most part, numbering a further 287 tanks, for a grand total of 453 tanks. There were additional tanks in other units, with the British forces operating about 700 tanks at the beginning of the offensive, plus a substantial reserve. The Afrikakorps' two panzer divisions (15. and 21.Panzer Div.) had 260 tanks at the start of *Crusader*, including 77 light PzKpfw II, 145 PzKpfw III and 38 PzKpfw IV, plus about 135 M-13/40 tanks with the Italian Ariete Division and no reserves.

The first combat use of the Stuart took place on 19 November 1941 in a sharp battle between the 8th Hussars and Kampfgruppe Stephan of Pz.Rgt.5 of the 21.Panzer Div. near Gabr Saleh. The 8th Hussars lost 20

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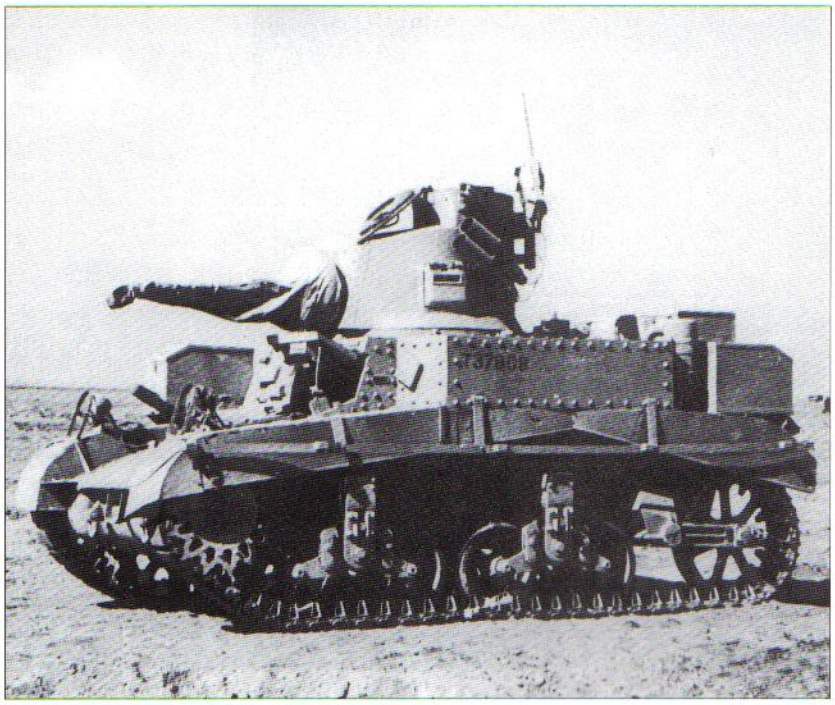
Stuarts, while the Germans lost two PzKpfw III and one PzKpfw II light tank. Heavy fighting by all three Stuart regiments took place the following day, and only 98 Stuarts were operational by the end of the day's combat. The Stuarts later took part in the intense fighting for the Sidi Rezegh airfield. The 4th Armoured Brigade was committed to the battle on the afternoon of 22 November. During the night of 22–23 November, tanks of I./Pz.Rgt.8 of 15.Panzer Division stumbled into the night leaguer of the 8th Hussars and the 4th Armoured Brigade headquarters. In the darkness and confusion they overwhelmed the unit, capturing the regiment's commander, 167 troops and 35 Stuart tanks. Only seven Stuart tanks managed to escape the debacle.



Following the heavy losses of Operation *Crusader*, the latest models of the Stuart were shipped to Egypt as part of the Lend-Lease program. This Stuart of the 7th Armoured Division has the new round turret fitted out at the workshops in Egypt in March 1942. It is from the original production batch of this turret, lacking the forward cupola view-slits. Some innovations had been added after *Crusader*, including the addition of smoke mortars on the turret, and a reinforced bracket for the sunshield deception devices.
(US Army MHI)

By Sunday 23 November 1941, the 7th Armoured Division was in a desperate situation, having suffered heavy tank losses in the preceding days, and now facing the full weight of both panzer divisions. By the end of the fighting on 23 November, the 7th Armoured Division had been reduced to about 35 Stuarts and 40 cruiser tanks. Having shattered the most powerful British formation, Rommel decided on a rash gamble, and on 24 November directed his forces to a race to the Egyptian frontier, hoping to snatch a quick victory. In the end, the Afrikakorps had suffered too many losses and was too exhausted to conduct so bold a venture. In December 1941, the Afrikakorps was forced to withdraw and Tobruk was relieved.

The decimation of the 7th Armoured Division in the initial fighting at Sidi Rezegh had more to do with tactical deficiencies than with technical problems. The German armor units were able to overcome their more numerous opponent with superior tactics, including a skilled use of tanks in co-ordination with the highly effective 50mm PaK 38 anti-tank gun and the legendary 88mm gun. Rommel remarked to a captured British officer, 'What difference does it make for me if you have two tanks to my one? You send them out and let me smash them in detail. You presented me with three brigades in succession.'

The fighting showed that the Stuart and Crusader tanks were barely adequate for tank fighting. This was not simply a matter of gun and armor. Although many accounts of the desert fighting suggest that the German tanks were better armored and had longer-range guns, this was not the case. The 30mm superstructure front armor of the PzKpfw III Ausf. G could theoretically be penetrated by the Honey's gun at 1,500 meters, while the PzKpfw III Ausf. G's 50mm gun could penetrate the

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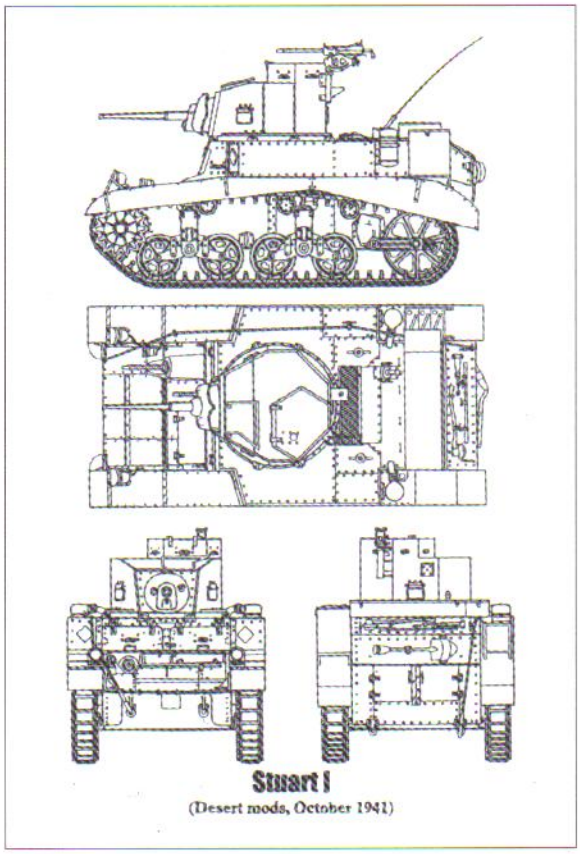
Honey's 38mm superstructure front at similar ranges. Most engagements took place at closer ranges where both tanks were vulnerable to each other's fire, and shots were often fired against the side armor of opposing tanks, where there was no clear advantage to either side.

The German advantage was in less appreciated factors such as tactics, training, command and control, and fightability of the tank. The PzKpfw III was better laid out for tank fighting than the Stuart, having a turret crew of three: commander, gunner and loader. The commander could concentrate on directing his tank, and co-ordinating its actions with those of neighboring tanks. The German tank periscope was superior, using an early form of stadiametric rangefinding. Gun elevation was geared, so that after firing the first shot, the German gunner could adjust his fire with precision.

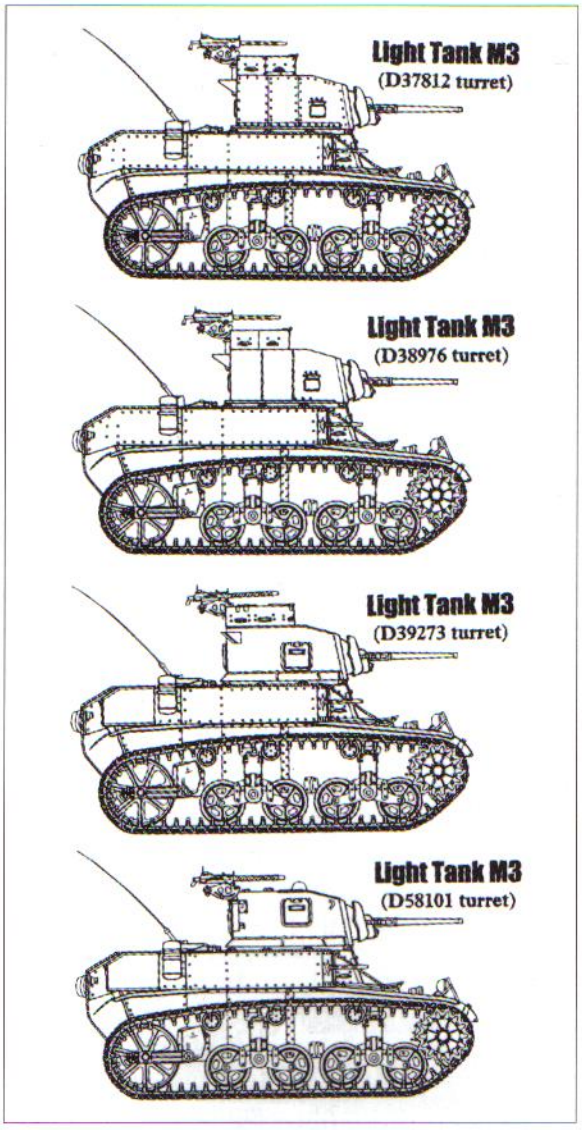
In the M3 light tank, the commander had to double up as gunner. This seriously distracted him from his function of observing enemy actions and made the tank almost blind in combat. When operating the gun, the commander had no means of vision other than the tank's telescopic sight, or a small pistol port. The British realized this shortcoming, and as an expedient, shifted crew functions. During combat, the commander moved to the rear of the turret, while the redundant hull co-driver moved into the turret and served as gunner. To accommodate the tank commander, an armored car-pattern sling seat was added under the turret cupola. In October 1941, plans were underway to substitute a rigid folding seat, shaped like that on a motorcycle, but it is not clear how many tanks, if any, received this modification before the battle began. In view of the small size of the Stuart turret, this change led to extremely cramped conditions. The gunner and loader lacked traversing seats, and had to clamber over the transmission tunnel running through the center of the fighting compartment.



Stuart I
(Desert mods, October 1941)

Another unusual feature of the Stuart was the location of the turret traversing wheel on the right (loader's) side of the turret, which British workshops changed to the left side. As a result of these features, Stuart crews tended to fight with the turret pointed directly forward, steering the tank towards the target and using the limited traverse of the M22 mount for precision aiming rather than the turret traverse. The 37mm gun in the early Stuart was usually elevated using a shoulder brace, and so in the event of a miss, the gunner could not adjust the succeeding shot with any precision. The M5A1 telescopic sight lacked a ranging feature. The British workshops in Egypt added a Philips internal communication set, enabling the commander to talk to the crew. British doctrine of the time still recommended firing from the move, but Stuart crews found that the most effective tactic was to close on the enemy as quickly as possible, make a quick halt, and then fire the main gun.

Although the Stuart was not equal to the PzKpfw III, it did not fare badly in comparison to British cruiser tanks of the period which were also decidedly inferior in durability. According to the 4th Armoured Brigade commander, only 12 Stuarts were lost due to mechanical breakdown during Operation *Crusader*. Indeed, it was the basic automotive reliability of the Stuart that helped keep the Desert Rats in the field in the later stages of the battle. Its main problem was its poor range: undamaged tanks were sometimes abandoned, and the need for frequent refueling stops restricted the mobility of the brigade. A number of intact Stuarts were recovered by the Germans in 1941 and more were captured in early 1942. By the time of the Gazala and El Alamein fighting, ten or 12 were in German service and they were sometimes designated as PzKpfw M3 747(a).



The Stuart continued to see combat in the January 1942 fighting. But following *Crusader*, shipments of the more powerful M3 Lee and Grant medium tanks began to arrive. As a result, the armored regiments began reorganizing, and gradually shifted to a composition of one squadron of Stuarts and two squadrons of Grants. By the time of the Gazala battles and the defense of the Alamein line in the spring of 1942, 12 of the armored regiments still included Stuart squadrons. Many of these were the new intermediate production type with the round homogenous turret and new vision ports. The role of the Stuart continued to decline as more modern equipment became available. As the new M4A1 Sherman medium tank began to arrive in the summer of 1942, the Stuarts were shifted out of the line squadrons, and transferred to reconnaissance. By the time of the Alamein offensive in the autumn of 1942, the Eighth Army was operating 128 Stuarts, about 11 percent of its force.

The second Lend-Lease recipient of the M3 light tank was the Soviet Union. The first of these were dispatched on PQ.2A which departed Britain on 13 October 1941. By December 1941, the Red Army had received 180 US tanks, including M3 light tanks and M3 medium tanks. The Soviets were not particularly fond of the M3 light tank, finding it to be lightly armored by their standards, too weakly armed to deal with the PzKpfw III or PzKpfw IV, and vulnerable to gasoline fires. Another problem was posed by fuel supply since Soviet gasoline tended to be 70 octane while the Stuart engine was configured for 80 octane. This led to engine carbonization problems and sluggish engine performance until a timing modification was introduced in 1943. The United States

originally shipped only armor-piercing ammunition with the tanks, which limited the usefulness of the M3 light tank when dealing with enemy infantry or anti-tank guns. Brazil was allotted a small number of M3 light tanks in August 1941 and the US Marine Corps was assigned 50 M3 light tanks in 1941.

First combat in Asia

The United States Army first deployed the M3 light tank overseas in September 1941 when it was decided to reinforce the US garrison in the Philippines with the Provisional Tank Group, equipped with 108 new tanks. The 192nd and 194th Tank Battalions had little or no experience on the new M3 light tanks before being shipped off to Manila, and the units lacked ammunition until a few days before the outbreak of the war. The main Japanese amphibious landing took place in the Lingayen Gulf to the east of Manila in late December 1941. The Provisional Tank Group counter-attacked shortly after the initial Japanese landings on Luzon. The first tank-vs.-tank engagement took place on 22 December 1941 when Japanese Type 95 Ha-go light tanks of the 4th Tank Regiment ambushed a patrol of M3 light tanks from the 192nd Tank Battalion near Damortis. The 4th Tank Regiment spearheaded the Japanese attack, while the US tankers often formed the rearguard of US forces. These two opposing tank units continued to skirmish as the US forces fell back towards the capital. In a confused night-time skirmish in the town of Baliuag, the Stuarts claimed eight Ha-gos in point-blank engagements. The US Army Provisional Tank Group was not used to its full potential because the higher commands were unfamiliar with tanks. Some surviving M3 light tanks were among the last of the US rearguard to

Like the infantry's M2A3 light tank, the cavalry's M1A1 combat car also was up-armored and had the spaced bogies. This M1A1 combat car was part of C Troop, 1st Cavalry during the May 1940 maneuvers.
(US National Archives)

withdraw into the Bataan Peninsula. The last tank-vs.-tank action took place on 7 April 1942 when two Japanese tanks were destroyed by the M3 light tanks on Bataan. The Japanese claim to have captured 31 M3 light tanks, and one was used during the final assault on Corregidor which brought the Philippines fighting to an end.

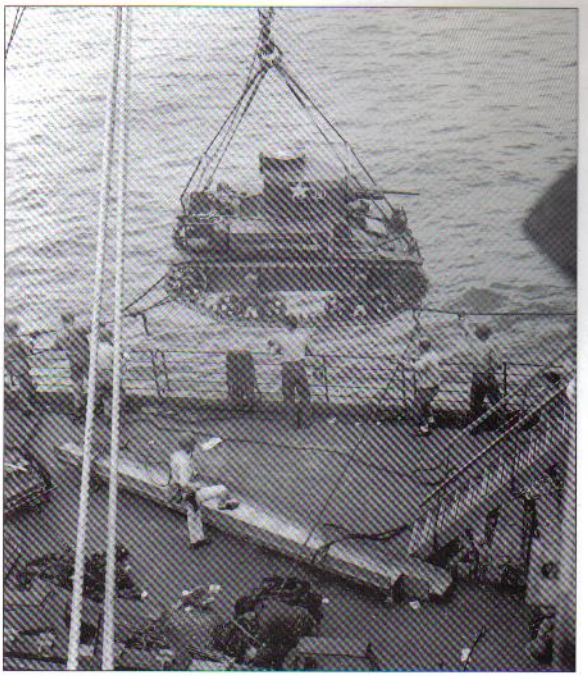
The M3 Stuart soon saw combat elsewhere in Asia. Following their victory in Malaya in February 1942, the Imperial Japanese Army (IJA) struck into Burma, spearheaded by three tank regiments. Britain dispatched the 7th Armoured Brigade consisting of two tank units hastily withdrawn from the North African campaign, the 2nd RTR and 7th Hussars. The 7th Hussars were equipped with Stuart light tanks and fought a series of costly rearguard actions, including several against the Japanese 14th Tank Regiment. By the time the survivors of the unit reached British lines in India, only one Stuart remained in action. But the Japanese advance had been brought to a halt short of India.

M3 DEVELOPMENT CONTINUED

In March 1941, work began on a third turret type (D39273) for the M3 light tank using formed, rolled homogenous armor, instead of face-hardened armor which required an increase in the basic thickness from 1 to 1.25ins. This turret was readily distinguishable from the earlier flat-sided turret by its rounded sides and the new Protectoscope vision devices in the side pistol ports. By the time this turret was ready for production, other improvements were ready. Protectoscopes were added to the driver and co-driver hatches in the front, and a new pattern stowage bin was added behind the air cleaners over the rear fenders. Series production of this version began in October 1941. In response to British requests, it was planned to fit a traversable periscope to the cupola for the commander. However, this was not fitted and without it, the commander's view was restricted. A total of 160 of these initial turrets were manufactured before four more view slits were added to the cupola, and a further 1,200 tanks were built with this turret from November 1941 to February 1942. This version first saw combat with British forces in North Africa in the spring of 1942.

One of the main efforts in the M3 light tank

The final combat car was the M2 with its higher turret. The most significant innovation in terms of evolution of the wartime Stuarts was the introduction of the trailing idler wheel, to better distribute the added weight of the armor. This was a late production vehicle, and included the Protectoscope vision devices on the drivers' hatches, a feature planned for the M2A1 combat car. By the time that this photo was taken in August 1941 during the Tennessee wargames, the combat cars had been absorbed into the new Armored Force, and redesignated as the M1A1 light tank. This particular vehicle served as the command tank of the new commander of the 2nd Armored Division, Gen. George S. Patton. *(US National Archives)*



Developed in parallel with the cavalry's M2 combat car, the infantry's M2A4 light tank was the first member of the family to be armed with a 37mm cannon. This vehicle introduced a new turret design that would set the pattern for the early Stuart series. However, it had several archaic features, notably the elevated idler wheel at the rear instead of the trailing idler of the M2 Combat Car. This particular tank, nicknamed 'The Blizzard', is being loaded into a landing craft. Co. A, 1st Marine Tank Battalion was landed on Guadalcanal in August 1942 to provide support for marine units fighting the Japanese. The unit was equipped with a mixture of M2A4 and M3 light tanks, and it was the only combat use of the M2A4 light tank in the Second World War. *(US Marine Corps)*

program was to increase production to meet US Army demands as well as those of new Lend-Lease recipients. One of the choke-points in tank production was the supply of engines, since the tank's Continental W-670 radial engines were also in demand for aircraft production. As a result, in September 1940, Ordnance authorized the production of M3 light tanks powered by a Guiberson T-1020 diesel engine. The first production of the M3 (Diesel) light tank began in June 1941, also at American Car & Foundry. These tanks were externally similar to the Continental-powered tanks, but had a slightly different arrangement of piping on the engine deck leading to the external air filters. In total, 1,285 M3 (Diesel) light tanks were produced, about 22 percent of the total. The diesel tanks were not popular in service, and Ordnance concluded that the problems resulted from poor engineering and inadequate inspection of the engine during manufacture. In addition, the US Army was very reluctant to deploy tanks fueled with both diesel and gasoline, preferring gasoline since it was also used in all other support vehicles. In March 1942 the Adjutant-General directed that the diesel-powered tanks were to be retained for stateside training where practical. The sole exception was the US Marine Corps, which preferred diesel-powered tanks as diesel fuel was widely available in the naval fuel network where it was used for landing craft engines.

A fourth and final turret type entered development in the summer of 1941. The Chief of the Armored Force had supported the retention of a cupola on the turret, but British liaison teams had recommended the use of a periscopic sight for the commander instead of a cupola and had begun to fit Vickers periscopes in their own Stuarts. In January 1942, it was finally decided to eliminate the cupola in favor of a modified roof design with two roof hatches to make it easier for the loader to escape. The new D58101 turret resembled the earlier D39273 round turret without the cupola and with the side Protectoscopes moved slightly. It was sometimes called the 'streamlined' or 'low-profile' turret in the US Army. During the course of production engineering, Ordnance was working in parallel on a more elaborate upgrade of the turret which would result in the M3A1 light tank. As a result, the D58101 turret had some features intended for the later type which were not fully utilized, such as cutouts in the roof armor for a gunner's periscopic sight, and a commander's traversable periscopic sight. Instead, they were plated over. Production of this final version of the M3 light tank began in February 1942.

In April 1942, Army Ground Forces ordered an evaluation of the new design, and a GHQ tank battalion stationed at the Desert Training Center was equipped with new production vehicles. The evaluation in September 1942 was scathing: 'This turret is practically useless as a fighting compartment. The tank commander and gunner are so cramped that they can operate only at greatly reduced efficiency. The

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two hatches in the turret are too small for quick ingress and egress to and from the vehicle.' The Desert Warfare Board recommended that the new version should not be standardized and/or issued to US troops. In the meantime, some of these tanks had been supplied to the Marine Corps and to some army units. However, the general dissatisfaction with the design meant that they were retained in the US for training or were transferred to other armies through the Lend-Lease program. Production of this version of the M3 light tank might have ended in May 1942 when the M3A1 light tank entered production, but the British were very unhappy about the M3A1's new turret basket and other features. As a result, the M3 light tank with the D58101 turret remained in production for Lend-Lease requirements in parallel to the M3A1 light tank until August 1942 when M3 production finally ceased. Since M3 production continued alongside M3A1 production for several months, the very late production M3 light tanks were fitted with later upgrades in parallel with the M3A1 such as the welded hull. This makes visual distinction between the two difficult, though the presence of sponson machine-guns or their mounts clearly identifies the earlier type. In Britain, this version was called the Stuart Hybrid, as it was viewed as a mix of the old M3 and the new M3A1 light tanks.

The creation of the Armored Force in 1940 led to a major expansion of US armored units. This is the original version of the M3 light tank with the riveted D37812 turret. Similar to the turret of the M2A4 light tank, it used a new type of external pistol port flap, and the gun was fitted in a new mount. The 37mm gun was installed by government arsenals after the tank was manufactured, and during the 1941 wargames, some tanks were hastily put into service before their guns were fitted like the vehicle in this photograph with a dummy gun. This tank from the 1st Armored Division is seen crossing the Catawba River on a pontoon bridge during the November 1941 Carolina maneuvers.
(US National Archives)

Improving the turret: the M3A1 Light Tank

The next stage of evolution in the M3 light tank design began in August 1941 and again focused on the turret in another attempt to clear up lingering shortcomings. The changes were extensive enough for the new version to be redesignated as the M3A1 light tank. US Army Ordnance was developing a number of gun fire control systems that eventually became merged into an 'integrated fighting compartment'. US Army studies had concluded that a gun stabilization system would allow tanks to fire more accurately on the move. In the case of the M3 light tank, a Westinghouse vertical-axis gyrostabilizer was fitted to the M23 combination gun mount. An Oilgear power turret traverse was also favored to facilitate turret rotation. But power traverse could be dangerous for the crew since they would find it difficult to move quickly as the turret traversed because of the obstruction presented by the power train tunnel running from the engine in the rear to the transmission in

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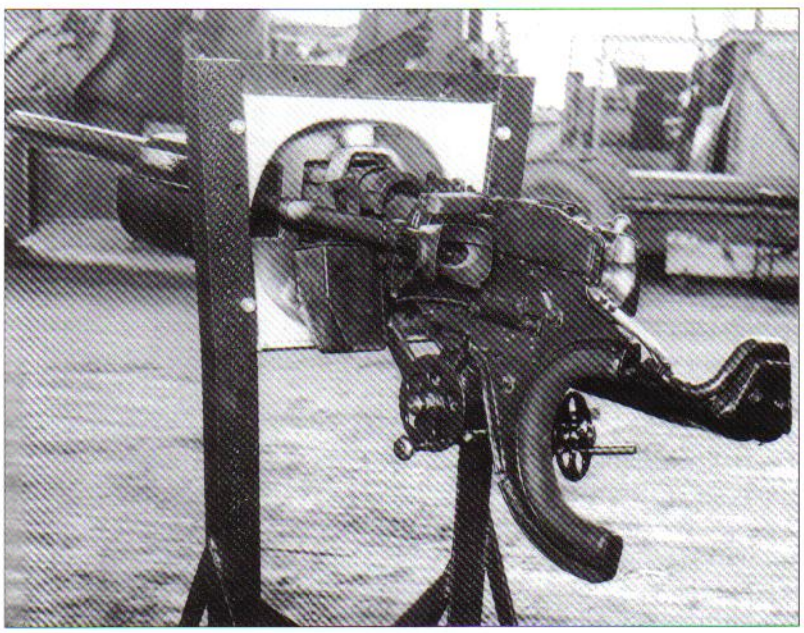
the front. The solution was a turret basket and associated reconfiguration of the internal hull ammunition stowage.

The new D58133 turret was essentially similar to the D58101 turret except for the turret basket and other new internal features. This turret altered the position of the turret crew, with the commander shifting to the right and taking over loading chores. However, the commander's station was now fitted with a traversable periscope for better surveillance, and the gunner's station also had a periscopic sight, linked to the improved combination gun mount. The M3A1 was also the first version of the M3 series regularly fitted with an internal vehicle intercom system. There was some doubt about the efficacy of the two sponson machine guns, so they were removed and the armor opening covered with a small circular plate (or deleted entirely on the final production batches). The first M3A1 light tank was completed in May 1942 and production began on a significant scale in July 1942.

The last major production change incorporated into the M3/M3A1 light tank series was a welded hull. The pilot version of this configuration appeared in January 1942, and it entered series production in the summer of 1942. Although intended for the M3A1 light tank, this feature also appeared on late M3 light tanks as well.

The M5 37mm gun with long recoil mechanism is seen here in the M20 combination mount used on the M2A4 light tank. The gunner elevated the gun using the shoulder rest evident here, and the gun pivoted a few degrees left and right as an alternative to using the turret traverse. The M22 combination mount used on the M3 light tank was very similar. ***(Patton Museum)***



Improving the hull: the M3A3 and M5 Light Tank

As a result of the pressure to reduce army reliance on aircraft engines for tank propulsion, in the summer of 1941 an M3 light tank was modified with a pair of Cadillac automobile engines connected to a Hydramatic automatic transmission. Further development of the type was authorized in November 1941 as the M4 light tank, with plans to incorporate a new and more spacious welded hull. The M4 was fitted with the same turret as the M3A1, but because it had a lower drive train, some of the components could be relocated to provide more room for the crew. Trials of the prototype were conducted in April 1942, but it was decided to redesignate the vehicle as the M5 light tank to avoid confusion with the new M4 medium tank. Production of the M5 took place at the Cadillac Motor Car Division and at the Massey Harris Company beginning in April and July 1942 respectively.

While this process was going on, the army concluded that similar hull improvements could benefit the M3 series still being produced at American Car & Foundry. The new M3A3 light tank hull used a sloped glacis plate like the M5 light tank, but also had sloped side armor. At the same time, it was decided to add a bustle to the turret to enable

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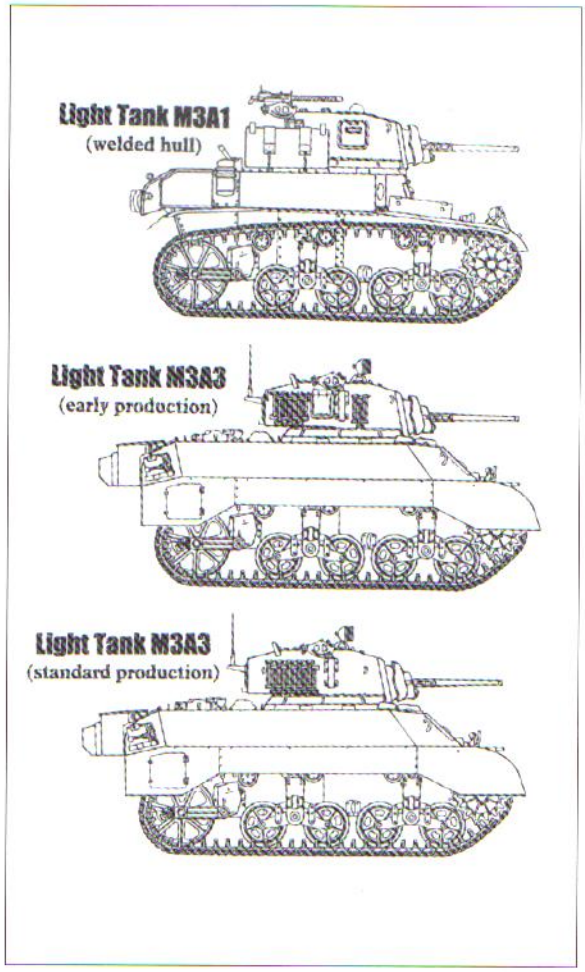
the radio to be located nearer to the commander in response to British requests. The pilot version of the M3A3 was completed in August 1942 and series production began at American Car & Foundry in January 1943.

By the autumn of 1942, the US Army had enough experience with the new M3A3 and M5 light tanks to make a better appreciation of their relative merits. The M5 was generally favored over the M3 series because of the automotive improvements of the new Cadillac engines and the automatic transmission. The only major advantage of the new M3A3 was the new turret bustle, and this was incorporated on the M5 light tank in September 1942 as the M5A1 light tank. As a result, the US Army decided to standardize on the M5 and M5A1 light tanks, and all of the M3A3 production was earmarked for Lend-Lease. When production of the M3A3 concluded in September 1943, American Car & Foundry moved production to the M5A1. At its peak in early 1944, three plants were producing the M5A1. Production halted in June 1944 when production shifted to the new M24 light tank.



As in earlier versions of the light tank series, there was considerable tinkering with turret designs. The initial production versions of both the M3A3 and M5A1 had pistol ports fitted to the turret sides. These were quickly removed, and the standard production turrets lacked this feature. In October 1942, the final turret type, the D59965, was developed which introduced a folding pintle mount for the external .30 cal. machine-gun on the right side of the turret along with a shield. Around the same time, a new stowage bin was developed for the rear of the hull and these features entered production by July 1943. Combat experience in the Pacific against the Japanese revealed that the M3 light tank could be disabled by shoving a metal bar through the spokes in the wheels. As a temporary expedient, the holes were plated over. The Kelsey-Hayes Wheel Co. developed a stamped metal cover for the roadwheels, and the improved C107926 wheel became standard in 1943.

The US Army began a program to replace the M3 light tank in March 1941 with the M7 light tank. This was originally a 16 ton design armed with a 37mm gun and enough armor to withstand German 37mm anti-tank gun fire. As the war continued, German anti-tank guns continued to increase in power. Additional armor was added to the M7 design, and its firepower was increased to a 57mm gun derived from the British 6-pdr., and finally to a 75mm gun. In the process, its weight increased from 16 tons to 28 tons, and its automotive performance suffered accordingly. Production started in December 1942, but the Armored Force categorically refused to accept the vehicle, arguing with the Ordnance branch that it had failed to meet its design

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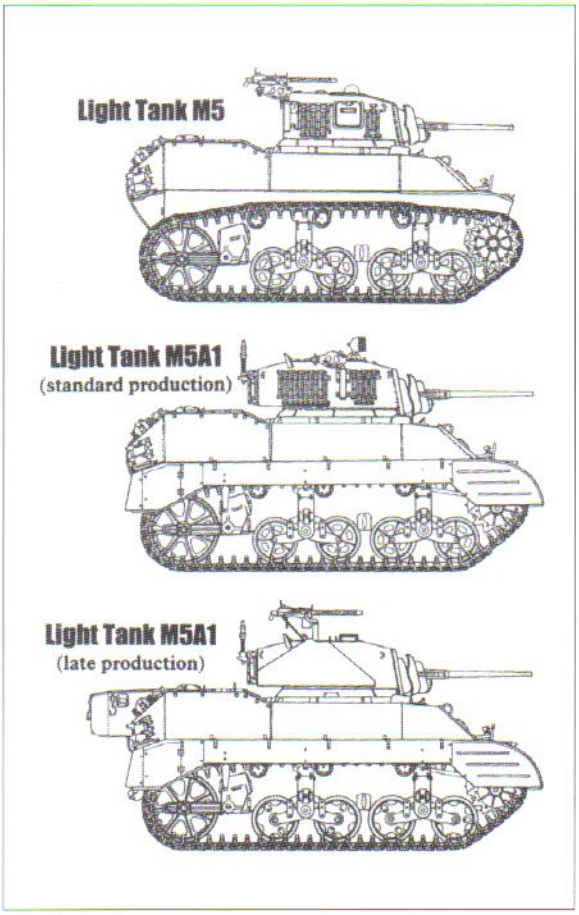
objectives and that the light tank had really become a medium tank which was heavier than the M4 Sherman but inferior in most other respects. The Army Ground Forces backed the Armored Force and only 30 production M7 tanks were completed. The problem was tactical more than technical. In 1941–2, the US Army still thought that a light tank was viable on the modern battlefield for major missions such as infantry support and tank fighting. Combat in North Africa in 1943 made it clear that this was no longer the case.

SPECIALIZED STUART VARIANTS

The M3 and M5 light tank series served as the basis for a wide variety of specialized armored vehicles including turretless scout vehicles, and as carriages for a variety of self-propelled weapons. However, only one of these types actually reached series production, the M8 75mm howitzer motor carriage (HMC). In June 1941, the Army authorized the development of a 75mm and 105mm assault howitzer on the M3 light tank chassis since it was felt that light battalions would need heavier firepower when encountering bunkers or other reinforced targets. A turretless version of the M3 light tank with a 75mm howitzer was completed in June 1942 as the T18 75mm HMC. But the weapon's lack of traverse and the vehicle's vertical armor led to its abandonment even before the pilot version was completed. The cancellation of the T18 HMC in April 1942 was followed by the initiation of work on a turreted vehicle, the T41 75mm HMC. Although originally planned for the M3 chassis, it was shifted to the M5 light tank chassis early in development. The M1A1 75mm pack howitzer was reconfigured in the new M7 mounting more suitable for armored vehicles. The howitzer was mounted in a large, open-topped turret. The new turret had a substantially larger turret ring than the M5 light tank turret. As a result, the two front hull hatches were sacrificed to make room and two small vision hatches were added in the glacis plate. The M8 75mm HMC was accepted for production in May 1942 and production was undertaken at Cadillac from September 1942 to January 1944. It first entered combat in significant numbers in 1944 during the Normandy campaign. Since light tank battalions were uncommon at this time, its primary role was to provide fire support in cavalry reconnaissance squadrons. Cavalry reconnaissance squadrons attached to armored divisions had eight of these, while non-divisional squadrons had six.



In contrast to most variants of the Stuart family, few M8 HMCs were delivered via Lend-Lease. The only other country to use the M8

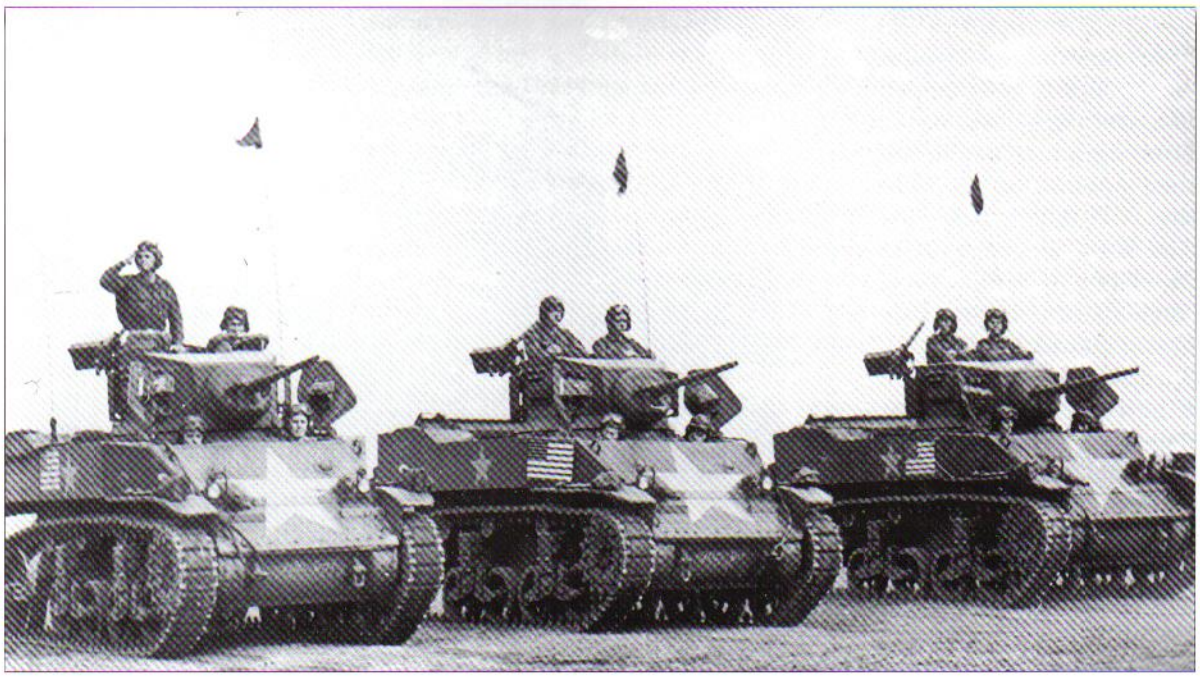
75mm HMC in significant numbers during the Second World War was France, because French armored units were configured along the American pattern. A 105mm howitzer motor carriage on the M5 chassis was developed late in the war as the T82, but by the time prototypes were ready in 1945, there was no requirement for such a vehicle and it never entered production.

THE M3 AND M5 IN COMBAT

North Africa

While the M3 Stuart light tank was moved to a reconnaissance role in the British Army by the summer of 1942, it still remained a central element in the US Army's armored divisions. Under the 1942 configuration, the two tank regiments in each division were each composed of two medium tank battalions and one light tank battalion. In addition, the army was still fielding separate GHQ tank battalions composed entirely of light tanks. The first extensive American use of the M3 light tank in combat since the Philippines came after Operation *Torch* in November 1942 when the US Army landed in North Africa. In small-scale fighting with the Vichy French in Morocco

The second production version of the M3 light tank introduced the D38976 welded turret which was essentially similar to the earlier riveted type except for the construction technique. This tank of the 2nd Armored Division at Fort Benning, Georgia, on 18 December 1941 shows all the crew, ammunition, parts and supplies that were crammed into this small vehicle. Although not apparent from this angle, the M3 light tanks of the 2nd Armored Division were mainly the diesel engine version at this time, a type that was not popular because of the difficulty in getting the engine started, especially in cold weather. ***(US Army MHI)***

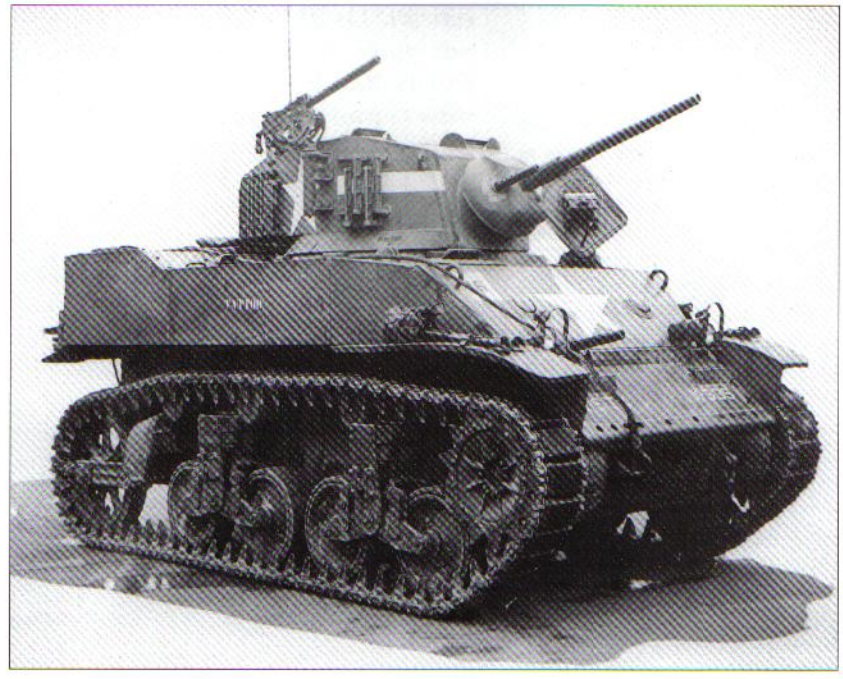


The M5 light tank made its combat debut with the 70th Tank Battalion (Light) in North Africa in November 1942. They are seen here during a parade for President Roosevelt during his visit to Casablanca in January 1943 and still retain the prominent US flag insignia from the Operation *Torch* landings. *(George Balin)*

shortly after the landings, there was at least one encounter between the 13th Armored Regiment, 1st Armored Division with a French Renault R.35 light tank company near St. Lucien, but the French lost 14 tanks with only one M3 light tank damaged. On 9 November 1942 the 70th Tank Battalion (Light), one of the first units equipped with the new M5A1 light tanks, engaged in a short fire-fight with French forces near Rabat, knocking out several French Renaults, but also losing one tank to an anti-tank gun.

Far more intense combat awaited the 1st Armored Division in Tunisia. The 1st Battalion, 1st Armored Regiment was the right wing of 'Blade Force', assigned to create a 'tank infested area' on either side of the Chouigui pass connecting the Tine River valley and the Tunis plain. The encounter began on 25 November 1942 when the headquarters company knocked out a pair of Italian Semovente L40 da 47/32 tank destroyers. On 25 November the US tankers encountered the Afrikakorps for the first time, in a violent engagement with 13 tanks of Pz.Abt.190. Both A Company and B Company were deployed in camouflaged static positions on either side of the Chouigui–Mateur road. The German attack was first met by the battalion's assault gun platoon, equipped with 75mm T30 howitzer motor carriages, an improvised vehicle consisting of an M3 half-track mounting a 75mm pack-howitzer. After several volleys, it became clear that the low-velocity howitzers were having no effect on the German tanks, and the platoon was ordered to withdraw under cover of smoke. The A Company commander, Major Singlin, ordered his company to attack the German column diagonally while B Company remained in position to provide fire support. The attack consisted of 12 M3 light tanks, led by Major Singlin in his command tank 'Iron Horse'. The skirmish made the inadequacies of the M3 light tank painfully clear as this later account by one of the platoon commanders attests:

'The 37mm gun of the little American M3 light tank popped and snapped like an angry cap pistol. From the partial defilade of their position on the right side of the attack, the American banged away at the German tank it had singled out as its very own in the column of Mark IV Specials. The Jerry seemed annoyed by these attentions. Questing about with his incredibly long, bell-snouted, 'souped-up'75mm KwK 40 rifle, the German commander soon spotted his heckler. Deciding to do the sporting thing and lessen the extreme range, he leisurely commenced closing the 140 yard gap between himself and the light tank, keeping his thicker, sloping frontal plates turned squarely to the hail of 37mm fire. The crew of the M3 redoubled the servicing of their piece. The loader crammed the little projectiles into the breech and the commander (who was also the gunner) squirted them at the foe. Ben Turpin couldn't miss at that range. Tracer-tailed armor piercing bolts streaked out of the American's muzzle and bounced from the plates of the Mark IV. The German shed sparks like a power-driven grindstone. In a frenzy of desperation and fading faith in their highly touted weapon, the M3 crew pumped more than eighteen rounds at the Jerry tank while it came in. Through the scope sight, the tracer could be seen to hit, then glance straight up. Popcorn balls thrown by Little Bo Peep would have been just as effective. Fifty yards away, the Jerry paused and loosed a round which ricocheted from the wadi bank short of the American, showering sand into the open turret hatches and screaming away like an undernourished banshee. For a long moment, it looked as though he intended to use his gun tube to pry the American tank from its cozy terrain wrinkle. But a few yards further, he pulled right and mounted a small hummock, completely destroying the slight defilade advantage of the American tank now some thirty yards away.



The development of an enlarged turret with a rear radio bustle for the M3A3 light tank led to the decision to use the same turret on the improved M5A1 light tank. This is a standard production example, with the simple M20 elevator bracket mount for the turret machine-gun.
(US Army MHI)

'The M3 commander decided that he was in a predicament known in the trade as "situation doubtful". A rapid retrograde movement to an alternate firing position was in order. The driver, half buried in the 37mm brass, was unable to receive the commander's foot and toe signals. So the commander crouched behind him and ordered him to back out at all possible speed, but to keep faced to the Jerry. The feeling as the M3 lurched backward up the wadi bank was one of relief – no one enjoys playing "clay pigeon M3". Death, unexpectedly deferred these many seconds, struck as the light tank bounced out of the wadi. The slug that was no doubt aimed at the turret, struck the vertical

When first committed to combat in North Africa in November 1942, most US Army light tank battalions were equipped with a mixture of M3 and M3A1 light tanks. This is an M3 light tank of the 1st Armored Division with the third, round turret type, during operations near Maknassy, Tunisia, in 1943. Unlike the British, the US Army retained the sponson machine-guns at this stage of the war. ***(US Army MHI)***

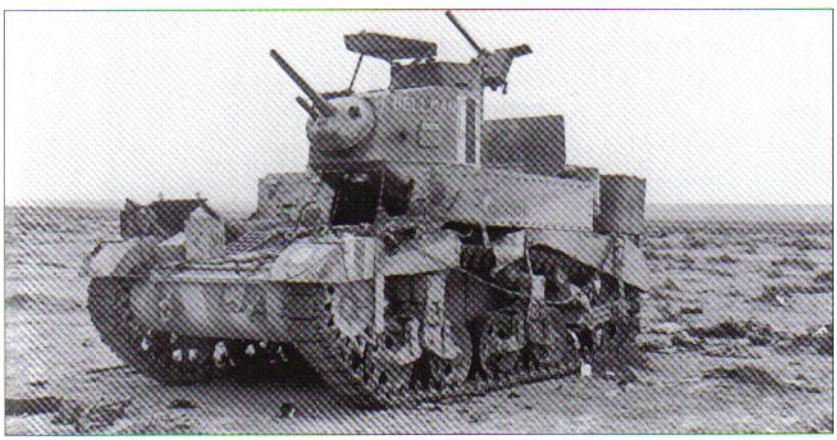
British workshops in Egypt made many modifications to the M3 light tank before issuing them to the troops. This included the addition of sand-skirts over the suspension, mounting brackets for sunshields, and additional stowage containers. This is Bellman, a tank from the 8th King's Royal Irish Hussars, knocked out during the initial skirmishes with Panzer Regiment.5 during Operation ***Crusader. (The Tank Museum)***

surface of the heavy armored driver's door and literally caved in the front of the M3. With its driver instantly dead, the bow gunner blind, stunned and bleeding, the loader cut down by machine gun fire as he sought cover, and its commander lying wounded on the ground, the little tank, though sheathed in flame, backed on through the battle until stopped by friendly hands.'*

In the tank duel in 'Happy Valley', A Company was decimated. But while the German tank column was distracted by A Company's attack, they exposed their thinner rear armor to B Company, and nine of the 13 German tanks were knocked out. A captured German tanker later mocked his captors saying that the 'Americans would lose the war because they built such poor tanks'.

Considering that this skirmish had come over a year after Operation *Crusader*, it should have come as no surprise that the M3 light tank was even less suitable in 1942 than it had been in 1941. By now, the M3 light tank was virtually hopeless in a frontal engagement against contemporary German medium tanks, since the 37mm gun could not penetrate the German tank at any reasonable range. Their only chance was a side or rear shot. In contrast, the PzKpfw III was now armed with a lethal, long 50mm gun and was protected by thicker armor, and the PzKpfw IV was fitted with an even more powerful, long 75mm gun. An assessment by the battalion reached three conclusions: that the 37mm gun was completely inadequate for tank fighting; that the tank had inadequate vision devices which forced the crew to operate with the hatches open thereby increasing its vulnerability; and that even in desert conditions the narrow track afforded poor flotation. Further fighting in Tunisia continued to raise grave doubts about the viability of the M3 and M3A1 light tanks when operating alone without medium tanks. The 1/1st Armored Regiment was not present at the disastrous battle for Kasserine Pass in February 1943, though the division's other light tank battalion, the 1/13th Armored, suffered heavy losses. The US defeat at Kasserine Pass had more to do with leadership problems, inadequate training, and inexperience than with specific technical shortcomings. But the defeat forced the US Army to take a close look at its armored doctrine, unit organization and equipment.

While the 1st Armored Division was equipped with the M3 and M3A1 light tanks, other units in Tunisia such as the 70th Tank Battalion (Light) were equipped with the M5 light tank. Used mainly to support Free French infantry units, this unit's experience with the M5 light tank was not significantly different from tank units with the M3A1. Their light tanks proved so



* Capt. Freeland A. Daubin Jr., *The Battle of Happy Valley*, The Armored School, Fort Knox, 24 April 1948. The author of this report served with A Company during this battle and lost his own tank.

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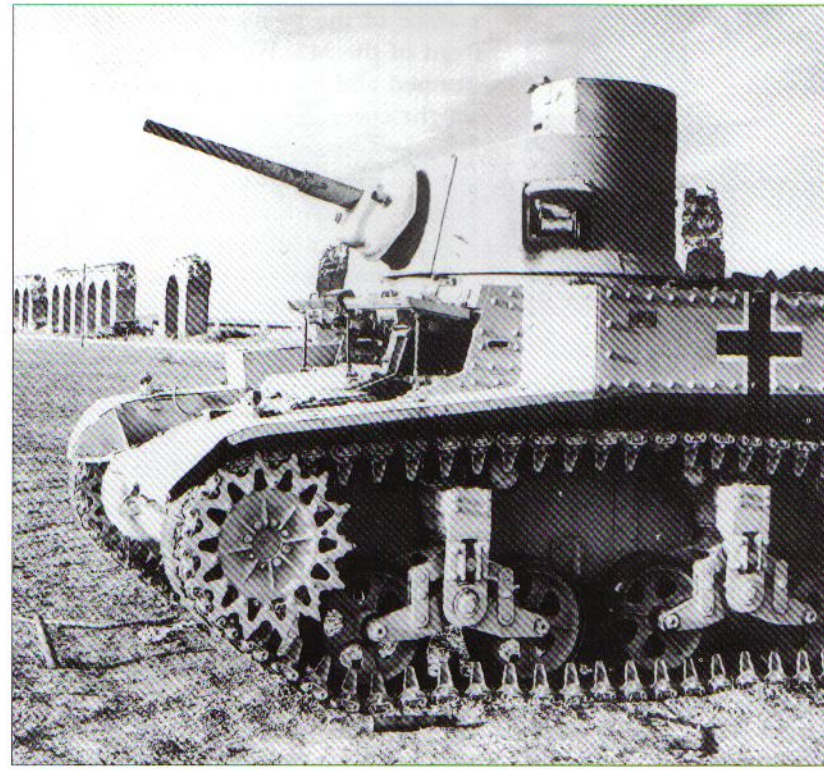
unsuited to fighting against German armor that on occasion the unit used their vehicles as bait to lure German tanks into ambushes set up in conjunction with the 601st Tank Destroyer Battalion. The surviving commander of the battalion wrote a strongly worded report to the Armored Force recommending that combat use of the M5 light tank be discontinued. His unit had found that in encounters with German infantry units, their 50mm PaK 38 and 75mm PaK 40 anti-tank guns out-ranged the 37mm gun on the M5, while at the same time, the tank's armor could not defend against these weapons. Encounters with German tanks clearly showed the superiority of the larger and heavier PzKpfw III and PzKpfw IV. Furthermore, it was found that the thin armor on the M5 made it vulnerable to enemy artillery fire.



The Afrikakorps made use of captured Stuarts on numerous occasions. This M3 light tank with the third type round turret was later recaptured by US forces at Cheylas, south of Tunis, in 1943. It was originally captured from US forces in 1943, repainted, and remarked in German insignia. *(US Army MHI)*

The Tunisia experience provoked debate among US military leaders in North Africa. In June 1943, Lt.Gen. Omar Bradley, commander of 2nd Corps, and Lt.Gen. George S. Patton, commander of the 1st Armored Corps (Reinforced), issued a directive that light tanks were only to be used for reconnaissance and flank security in view of their weakness in dealing with current German tanks and anti-tank guns. The lessons of the North Africa campaign were already under intense scrutiny by the Armored Force in the United States, and plans were underway to reorganize the armored divisions to take into account the inadequacies of the light tanks. Under the new armored division structure, the light tank battalions were abolished. Instead, tank battalions would be organized around three M4 medium tank companies and one company of M5 light tanks. The light tanks were deemed suitable for battalion reconnaissance and flank security, but there was some debate whether it would be wiser to trim the light tank strength back to only a platoon per battalion. The separate GHQ light tank battalions were mostly reconfigured, though dwindling numbers of light tank battalions were used in the Sicily campaign, in Italy, and even in north-west Europe.

While the M3A1 and M5A1 light tanks were increasingly obsolete, they could still be used successfully under the right circumstances. The fighting in Sicily provided examples. During the fighting for the village of Barrafranca on 16 July 1943, the Germans launched a counter-attack

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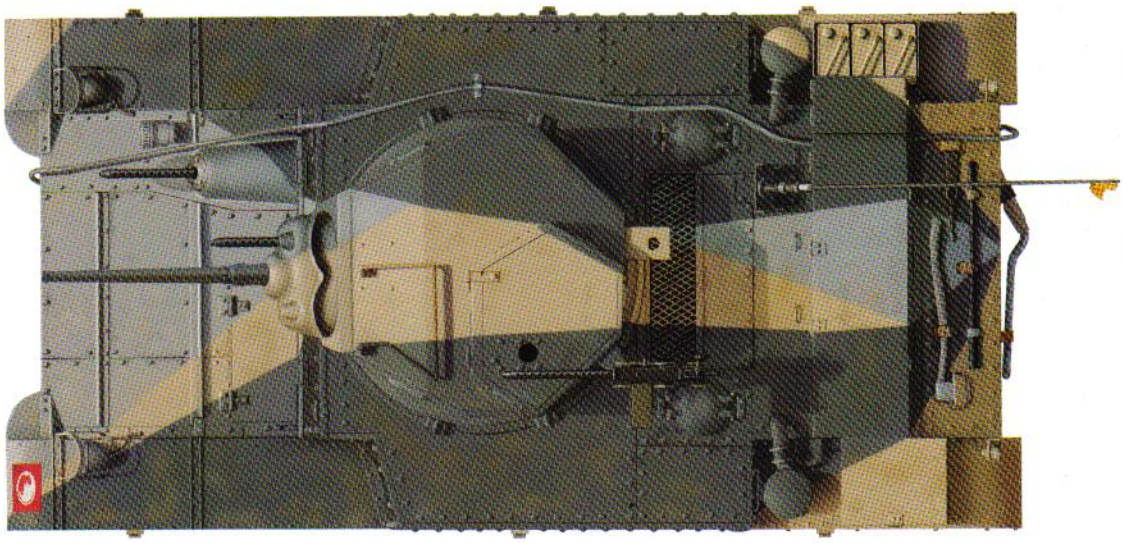
Stuart I, 8th King's Royal Irish Hussars,
4th Armd. Bde., 7th Armd. Div.,
Operation *Crusader*, November 1941



M1A1 Light Tank, 2nd Armd. Div., Fort Benning, Georgia, 1941

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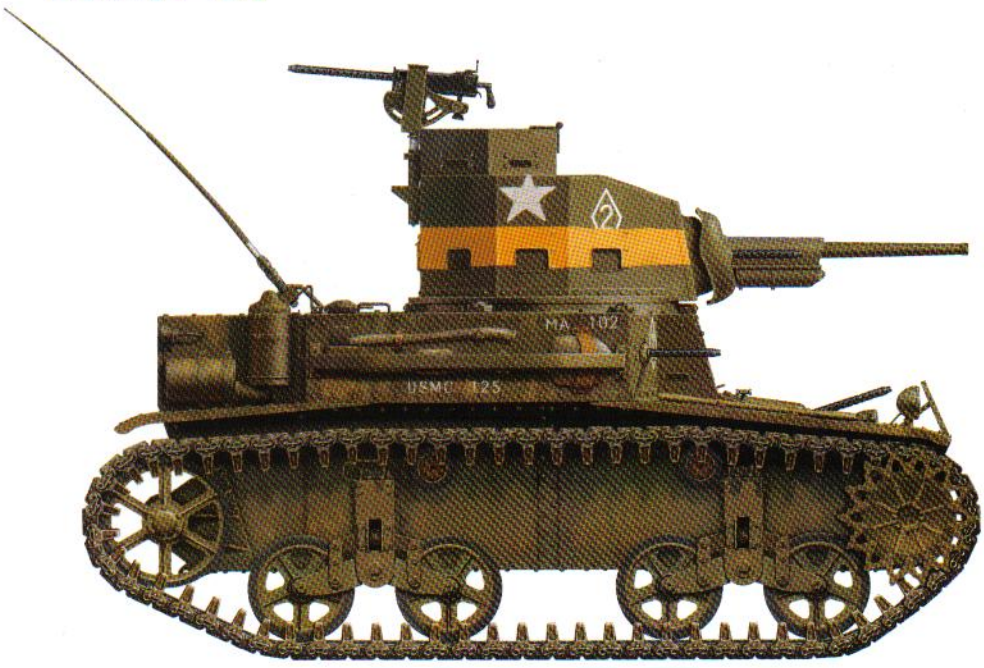
1 M3 Light Tank, Co. B, 192nd Tank Bn., Philippines, December 1941

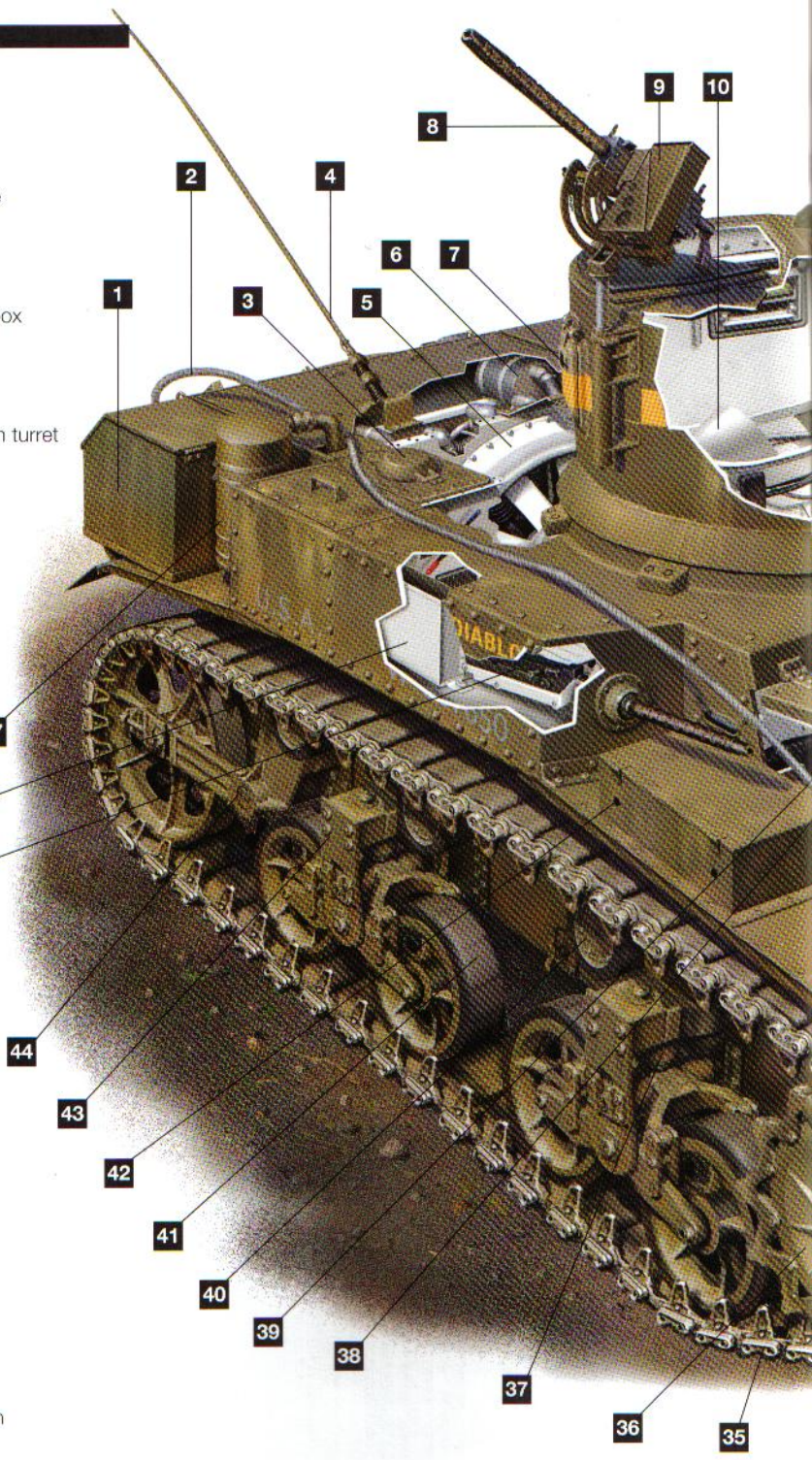
2 M2A4 Light Tank, Co. A, 1st Marine Tank Bn., Guadalcanal, September 1942

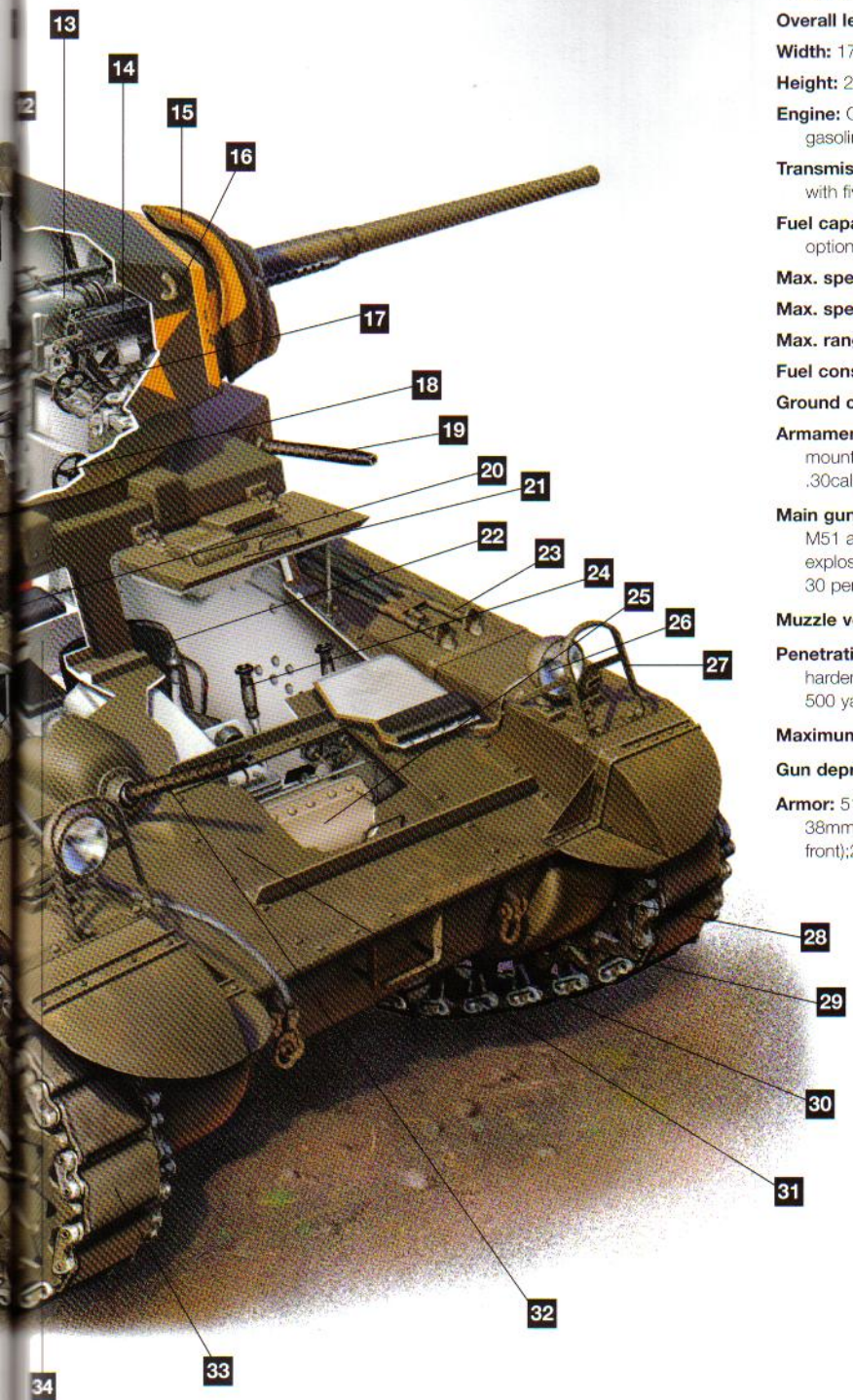


M3 LIGHT TANK

KEY

1 Stowage bin
2 Tow cable
3 Armored cover for fuel filler cap
4 Radio aerial
5 Continental W670-9A radial engine
6 Engine muffler
7 Protectoscope pistol port
8 Browning .30cal. machine-gun
9 .30cal. machine-gun ammunition box
10 Gun mount protective cage
11 Gunner's periscope
12 Firewall
13 37mm M6 gun in M22 combination turret
14 Co-axial .30cal. machine-gun
15 Gun mantlet
16 Turret lifting ring
17 Gun elevation wheel
18 Turret traverse wheel
19 .30cal. sponson machine-gun
20 Gunner's seat cushion
21 Driver's Protectoscope view port
22 Driver's seat
23 .30cal. machine-gun tripod
24 Driver's controls
25 Synchromesh transmission
26 Headlight
27 Headlight brush guard
28 Transmission housing cover
29 Towing shackle
30 Foot step
31 Glacis plate
32 .30cal. bow machine-gun
33 Rubber track block
34 Ammunition bin
35 Track end connector
36 Drive sprocket
37 Vertical volute spring
38 Transmission tunnel cover
39 Assistant driver's seat
40 Return roller
41 Rubber-rimmed road wheel
42 Windshield stowage box
43 Vertical volute suspension bogie
44 Trailer idler wheel assembly
45 Sponson machine-gun mount
46 Sponson machine-gun ammunition
47 Engine air filter





SPECIFICATION

Crew: 4

Combat weight: 13.7 tons

Power-to-weight ratio: 18.2hp/T

Overall length: 14.8ft

Width: 17.3ft

Height: 2ft

Engine: Continental W-670-9A radial 7-cylinder gasoline engine with 667 in3 displacement

Transmission: Synchromesh transmission with five forward gears, one reverse

Fuel capacity: 56 gallons internal with two optional 25 gallon jettisonable fuel tanks

Max. speed (road): 36mph

Max. speed (cross country): 20mph

Max. range: 75 miles

Fuel consumption: 1.3 gallons per mile

Ground clearance: 16.5in.

Armament: 37mm M6 gun in M22 combination mount with co-axial .30cal. machine-gun+ four .30cal. Browning machine-guns

Main gun ammunition: 103 rounds of armor-piercing, M51 armor-piercing-capped, M63 high explosive,M2 canister (60 percent HE, 30 percent AP, 10 percent cannister)

Muzzle velocity: 2,900ft/s (M51APC)

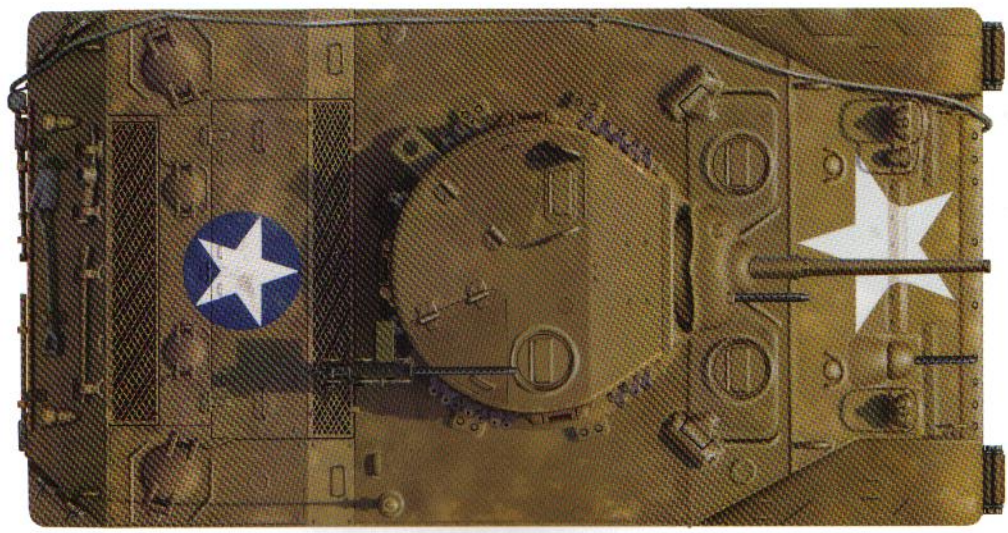
Penetration: (M51 APC; homogenous/face hardened armor at 30 degrees)53/45mm at 500 yards; 45/51mm at 1,000 yards

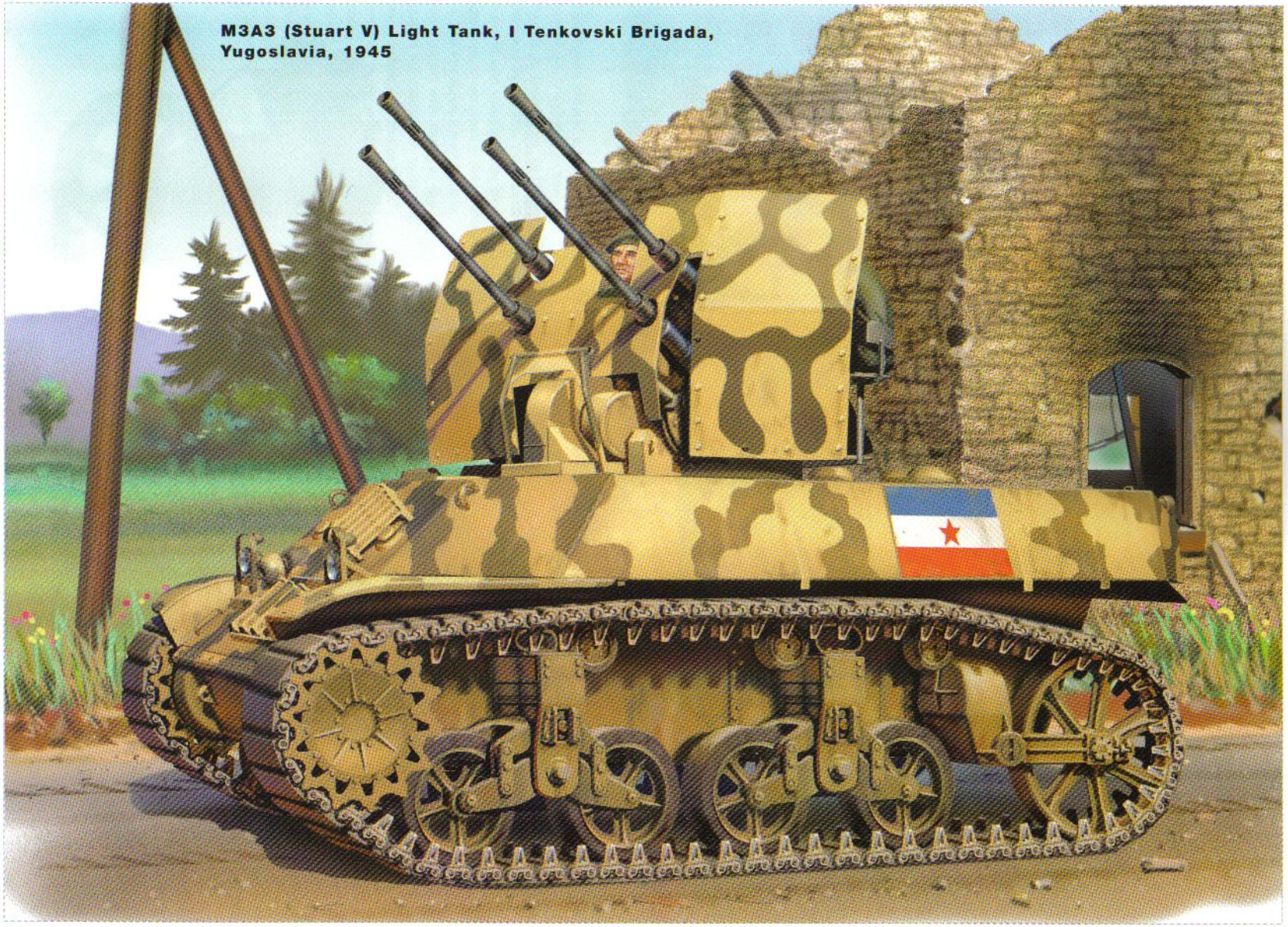
Maximum effective range: 12,850 yards

Gun depression/elevation: -10 to +20°

Armor: 51mm (gun mahtlet);38mm (turret sides); 38mm (hull upper front);44mm (hull lower front);25mm (hull sides)

**M5 Light Tank, Co. C,
70th Tank Bn. (L),
Oran, Morocco,
January 1943**




M3A3 (Stuart V) Light Tank, I Tenkovski Brigada,
Yugoslavia, 1945

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1 **M5A1, 601st Tank Destroyer Bn., Volturno River, Italy, October 1943**

2 **M8 Howitzer Motor Carriage, Régiment de Marche du Tchad, 2e Division Blindée, France, 1944**

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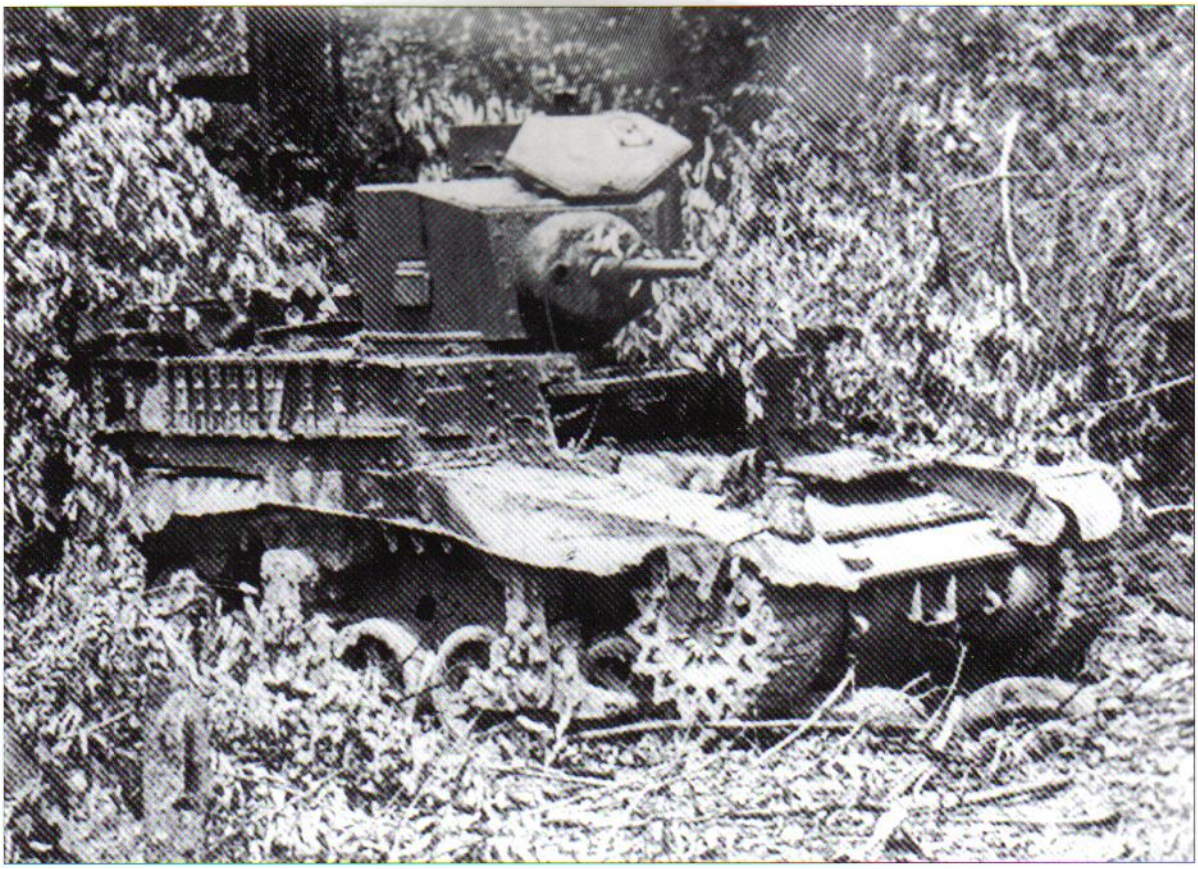


The Stuart played a prominent role in early fighting in the Pacific in December 1941 and January 1942. The 7th Hussars, trained and equipped for desert warfare, were hastily dispatched to the Far East. Their Stuarts were fitted with many of the desert modifications including sand skirts and the external grouser stowage on the sponson sides. The regiment fought a bitter delaying action against the Japanese in Burma, and only a single tank of the unit survived the withdrawal into India. ***(The Tank Museum)***

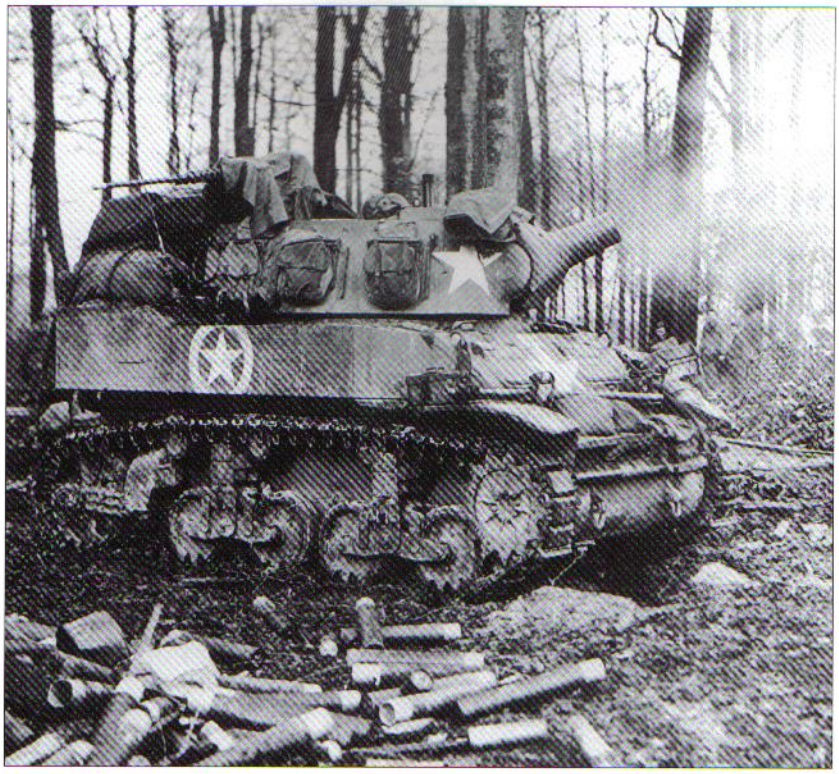
against the US 1st Infantry Division with 16 PzKpfw IV medium tanks of the *Herman Göring* Panzer Division. Two companies of M5A1 light tanks of the 70th Tank Battalion (Light) had taken positions on high ground on either side of the main road. A tank battle ensued and the German attack was repulsed, with the loss of five German tanks to the light tanks and four more to supporting artillery, without any US tank losses.

The Stuart in the Pacific

While the M3 and M5 light tanks had proved poorly suited to tank fighting in the European theater, they remained a viable and effective weapon in the Pacific war. Following the employment of M3 light tanks in the Philippines and Burma, their next combat use was on New Guinea and in the Solomons in the summer of 1942. In August 1942, Co. A, 1st Marine Tank Battalion disembarked on Guadalcanal with its M2A4 and M3 light tanks, followed in November by Co. B, 2nd Marine Tank Battalion. The use of tanks in the Pacific was significantly different from in North Africa, and they were used primarily for close infantry support against bunkers. While their small 37mm gun was not ideal for destroying reinforced log and earth bunkers, it was impractical to use larger and heavier tanks in the jungle conditions. Tanks were also effective in defense to repel Japanese infantry counter-attacks, using canister shot from their 37mm guns, as well as machine-gun fire. The Japanese infantry was very poorly equipped with anti-tank weapons, and resorted to heroic but suicidal close-range attacks on the tanks using

improvised means such as satchel charges. The M3 light tanks tried to operate in pairs, with one tank spraying the other with machine-gun fire to ward off the Japanese infantry, intent on prying open hatches with bayonets. The brutal close-quarter fighting was so savage that veterans recalled that the blood-splashed tanks looked 'like meat-grinders'.

The Imperial Jap-anese Army (IJA) seized New Britain and New Ireland in August 1942, and in September conducted amphibious landings on New Guinea, supported by Type 95 Ha-go light tanks. The threat to Australia led to the first commitment of Australian tanks in this theater. Stuarts of 2/6th Armoured Regiment were first sent into combat around Cape Endaiadere to support Australian infantry. During the subsequent Buna campaign, lasting into 1943, the tanks provided vital firepower support for the Australian infantry. The jungle and mountain conditions were atrocious, and made the deployment of any tanks, even light tanks, very difficult. The Australians introduced their own modifications to the Stuarts to frustrate Japanese efforts to disable them.



The only self-propelled gun version of the Stuart to reach production was the M8 75mm howitzer motor carriage. This mounted a short 75mm howitzer in an open turret on a modified M5 light tank hull. There were six of these assigned to each armored cavalry squadron, providing fire support to other vehicles in the unit with their short-barreled 75mm howitzer. This is a US Army M8 75mm HMC of Troop E, 106th Cavalry Reconnaissance Squadron during the fighting near Karlsbrunn on 2 February 1945. This vehicle is fitted with the Kelsey-Hayes road-wheels, and the standard T16 block track with grousers attached for better traction in mud. ***(US Army MHI)***

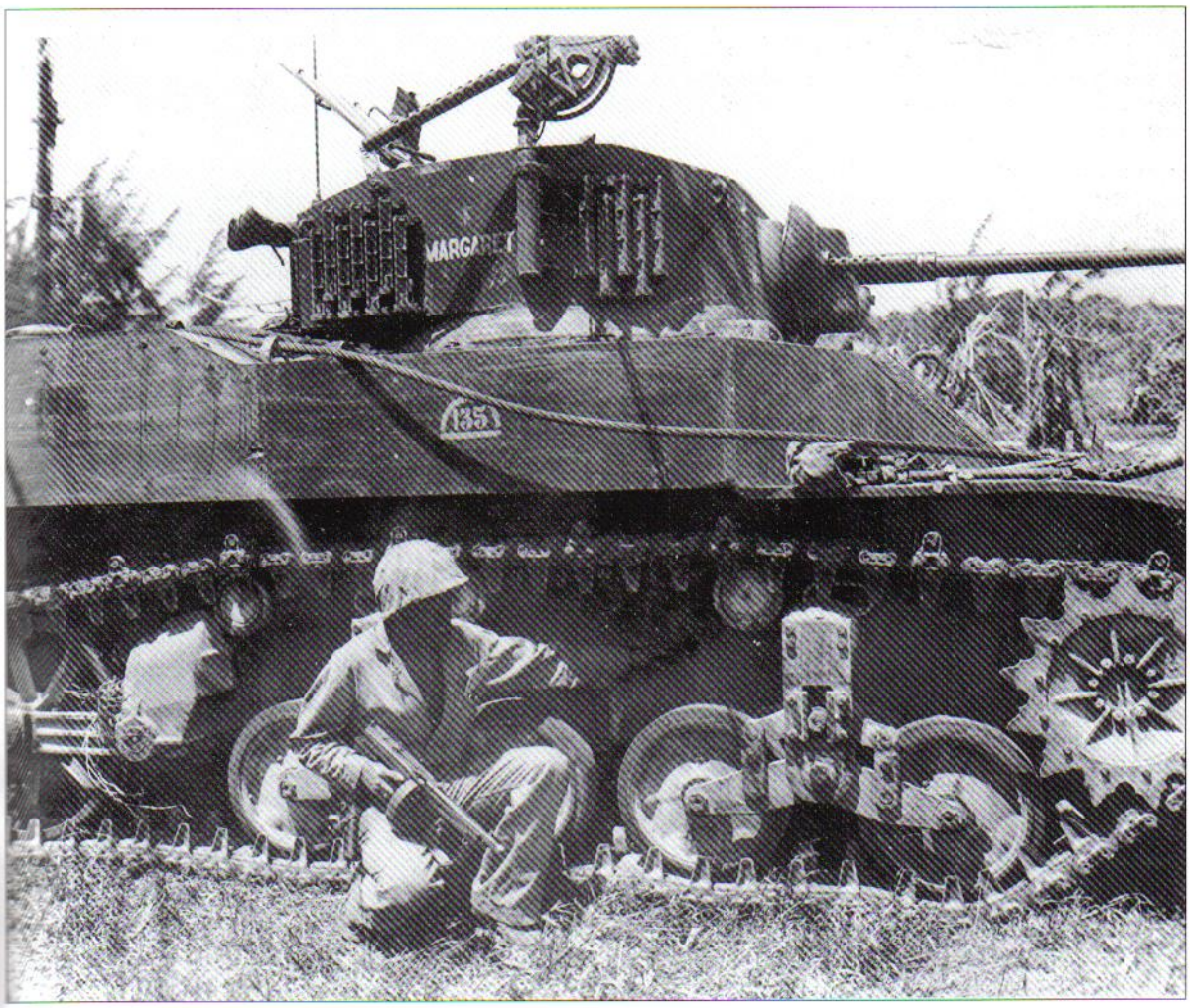
In July 1943 the US Army and Marines began operations on New Georgia, capturing Munda airfield with the support of three M3A1 light tank platoons from the marine defense battalions. The US offensive spread to Bougainville in November 1943, one of the longest campaigns in the south-west Pacific fighting, with harsh jungle conditions and stiff Japanese resistance. The 3rd Marine Tank Battalion's M3A1 light tanks helped capture the airfield during the initial landings at Cape Torokina, but were halted by dense jungle and heavy rains. Nearly all of the areas were heavily forested with jungle growth, and often the open areas and trails were too wet and sodden to support the weight of tanks. By late 1943, the M3 Stuarts in the south Pacific began to be replaced by heavier tanks, M4 medium tanks in the case of US Army and US Marine units, and the Matilda infantry tank for the Australian units.

Light tanks were also widely used in the central Pacific fighting. In contrast to the jungles and mountains of the south Pacific, the central Pacific battles involved amphibious assaults on many small islands and atolls, and the more open terrain led to a wider use of tanks. The first and bloodiest of these battles was at Tarawa in the coral atolls of the Gilbert Islands on 20 November 1943. The initial marine landings were

supported by M4A2 medium tanks. On the following two days, M3A1 light tanks of the 2nd Marine Tank Battalion were landed. The 37mm gun was ineffective against Japanese ferro-concrete bunkers, forcing marine tankers to drive right up to the target to fire high-explosive rounds directly through the gun-slits. The tiny atoll of Tarawa was taken in three days of fighting at a horrible cost. At the time, the M3A1 light tank was the standard equipment of the USMC tank battalions, and its uninspiring performance against Japanese bunkers led the marines to convert their tank battalions over to the M4A2 medium tank as they became available. Tarawa also showed the need for flame-thrower tanks, since no tank gun could possibly penetrate the thick bunkers created by the Japanese engineers, and many of the Marine M3A1s were subsequently converted to flame-thrower tanks.

In February 1944, concerns that the amphibious assault on Kwajalein would be another costly battle like Tarawa, meant that additional tanks were assigned to the assault force. On 1 February 1944, the 4th Marine Division landed on the adjoining Roi-Namur Islands with the 4th Marine Tank Battalion, and US Army units attacked islands in the Kwajalein atoll with the help of the 767th Tank Battalion. Although both tank units used

US Marine tank battalions used the M5A1 light tank in small numbers in the final campaigns in the Pacific, usually allotting one per Satan light tank flame-thrower platoon to provide gunfire support if Japanese tanks were encountered. This is 'Margaret' with the 4th Marine Tank Battalion on Saipan in July 1944. ***(US Marine Corps)***



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primarily medium tanks, they also employed M5A1 light tanks in the fighting. The fighting in the Marshalls made it clear that the Japanese Army had neglected anti-tank defense and their own tanks were hopelessly obsolete even compared to the M3A1 light tank. By the time of the Saipan landings in the Marianas on 15 June 1944, the Marine tank battalions had been completely re-organized with 46 M4A2 medium tanks instead of the original 54 M3A1 light tanks. Each tank battalion also had an additional 14 to 24 M3A1 light tanks converted to Satan flame-throwers. After landing, the Marine 2nd and 4th Tank Battalions were divided into small company-sized battle groups to provide fire support for marines attacking entrenched Japanese positions. The following day, the army's 27th Division landed, and tank support included two M5A1 light tank companies from the 762nd and 766th Tank Battalions. There was a significant amount of tank fighting on Saipan, since the Japanese had deployed both the army's 9th Tank Regiment as well as several Special Naval Landing Force (SNLF) tank companies. On 24 July, the assault shifted to nearby Tinian, and the marines were again supported by the 2nd and 4th Marine Tank Battalions, including their M3A1 Satan flame-thrower tanks. By the conclusion of the Marianas campaign in the summer of 1944, the M3A1 and M5A1 light tanks were no longer important in either marine or army tank operations, though both types continued to be used in dwindling numbers.

The one theater where the Stuart continued to play a role was in Burma. US and Chinese troops formed the jointly manned Provisional

Although the M3A1 light tank was obsolete in Europe by 1943, it remained an effective weapon in the Pacific theater. This is an M3A1 light tank of the US Army's C Company, 193rd Tank Battalion on Makin Atoll in the Gilberts. A company of these tanks were used on Makin while the marines were assaulting neighboring Tarawa in November 1943. This M3A1 light tank is moving forward near Red Beach in front of the 165th Infantry to eliminate Japanese snipers on 20 November 1943 shortly after the initial landings on Butaritari. It still has its fording trunk on the engine deck, used to permit the tank to wade ashore from landing craft.
(US National Archives)

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Australia began receiving Stuart light tanks via the British Lend-Lease allotments from the autumn of 1941. Before being introduced to combat in New Guinea, the vehicles were modified in Australian workshops, with the addition of a protective ring around the base of the turret to prevent the Japanese infantry from jamming it. This is a Stuart of the 2/6th Armoured Regiment during operations near Popendetta, New Guinea, on 19 May 1943. It uses the third turret type.
(US National Archives)

Chinese Tank Group with four battalions of M3A3 Stuarts and two of M4A4 Shermans. They took part in the Chinese offensive along the Burma Road and into southern China. Most British units taking part in the 1944–5 fighting had been re-equipped with Lee or Sherman medium tanks. However, the Indian armored force still used the Stuart in some numbers. The first Stuarts had arrived in India in 1941, though the conversion of cavalry regiments to armor did not take place in earnest until 1942–3. Of its 18 armored regiments, at least three Indian regiments were equipped mainly with the Stuart in early 1943: the 7th Light Cavalry, the 18th KEO Cavalry and the 45th Cavalry. The 7th Light Cavalry was the first Indian armored unit to see combat in March 1944. As part of the 254th Indian Tank Brigade, the unit took part in the Imphal and Kohima campaign, and participated in the retaking of Burma in 1945. The 45th Cavalry of the 50th Indian Tank Brigade took part in the later stages of the Arakan campaign in February 1945.

The Stuart in Northern Europe 1944–5

Although the Stuart was no longer ideal for infantry support or tank operations, it could still be employed for other tasks. So many Stuarts were available that there was never any real thought of abandoning them, in spite of their shortcomings. In 1943–4 alone, the US supplied 5,300 Stuarts via Lend-Lease, mainly to Britain. In turn, these were passed on to Commonwealth forces such as Canada, Australia, New Zealand and South Africa, as well as to other Allied forces equipped from British stockpiles, such as Polish troops. The United States also provided more than 530 M3A3 and M5A1 light tanks to De Gaulle's Free French forces. After the M7 light tank failure, a second Stuart replacement was begun in March 1943, emerging as the M24 Chafee light tank. The M24 light tank was better armed than the M5A1 with a 75mm gun, and it was a thoroughly modern design. Production began

in April 1944, but the first vehicles did not appear on the battlefield until December 1944.

By the time of the 1944 Normandy invasion, the M3A3 and M5A1 light tanks were widely used throughout the Allied forces. In the US Army, each tank battalion had a company of M5A1 light tanks, a total of 17 M5A1 light tanks, 53 M4 medium tanks and six M4 105mm howitzer tanks. During the Normandy campaign, at least two separate GHQ tank battalions, the 744th and 759th, retained the light tank configuration. US armored divisions had 77 light tanks each, 17 each in the three tank battalions, 17 in a cavalry reconnaissance squadron, and nine in headquarters companies. Other specialized units also used the M5A1, including non-divisional cavalry reconnaissance squadrons. By September 1944, the US 12th Army Group had seven armored divisions, 16 separate tank battalions and eight cavalry groups operational in north-west Europe, with a combined organizational establishment of over 1,110 M5A1 light tanks. The French Army also followed US organization but used both M3A3 and M5A1 light tanks.

The M5 light tank was used most intensively in the first months after the Normandy landings. Patton's Third Army, for example, lost 308 M5A1 tanks during the 1944-5 fighting, of which nearly half were lost in August and September 1944 alone. A similar pattern was repeated in Hodge's First Army which suffered the majority of its light tank casualties in June-September 1944. The heavy casualties in the light tank companies led tank commanders to exercise caution in employing the M5A1 light tank, and the diminishing casualties in later months was due

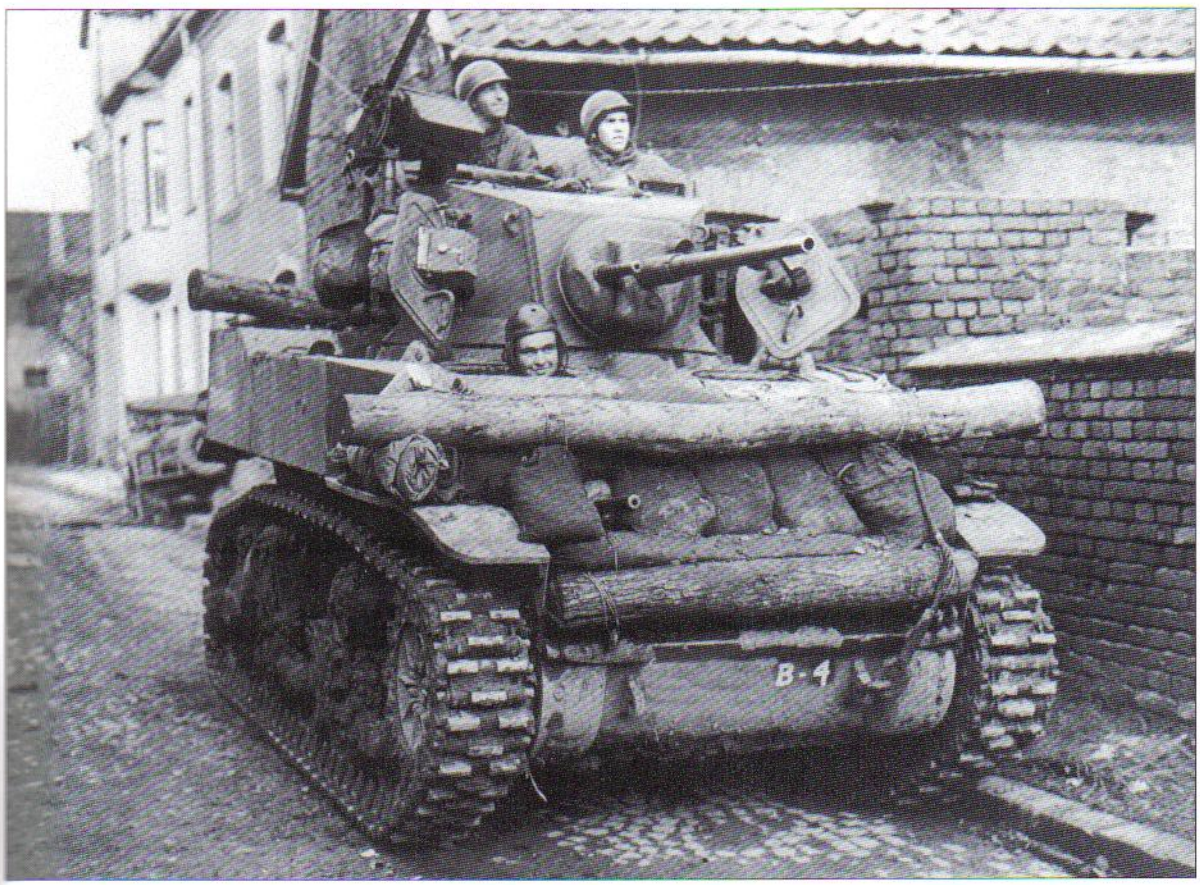
The Red Army used Lend-Lease M3 light tanks through much of the war though the type was never very popular. The marking on the hull side is 'Kuibyshev' named either after the Bolshevik hero or the city named for him. This is a late production version of the M3 light tank, called the Stuart Hybrid by the British, which used the new D58101 round turret without the cupola. It can be distinguished from the later M3A1 light tank by its sponson machine-gun fittings, which were plated over on the M3A1 light tank. This particular tank was produced in March 1942, and so is one of the earliest examples of the use of the new turret.
(National Archives)

in no small measure to restricting the missions of the light tanks to reduce their vulnerability.

By September 1944, the heavy losses suffered in the fighting in Normandy led the Armored Section of Gen. Bradley's 12th Army Group headquarters to request that all M5A1 light tanks be replaced as soon as possible by the new M24 light tank. The War Department in Washington did not concur, citing shipping and logistics problems. As a result, a policy was established to replace the M5A1 in the most vulnerable units, namely the corps' cavalry and the armored divisions' reconnaissance squadrons where the M5A1 light tanks did not have the support of M4 medium tanks. The only armored division to replace most of its M5A1 tanks in the tank battalions was the 7th Armored Division.

In addition to its recognized vulnerability to German tanks and anti-tank guns, the M5A1 light tank faced a new foe in north-west Europe: German infantry rocket anti-tank weapons such as the panzerfaust. These weapons accounted for about 15 percent of M5A1 losses, while tank and anti-tank guns caused 55 percent, and mines about 25 percent. The poor armor protection of the M5A1 resulted in a higher rate of crew casualties than in medium tanks, with a medium tank crew having about a one-in-five chance of becoming a casualty when their tank was knocked out, compared to a one-in-three chance in light tanks. A report to Gen. Dwight Eisenhower from the 2nd Armored Division in 1945 concluded: 'The M5 light tank is obsolete in

By 1944, the M5A1 light tank was obsolete for tank fighting and relegated to secondary missions such as reconnaissance and flank security. Nevertheless, it inevitably ran into German anti-tanks and panzerfaust rockets, which made its vulnerability all too clear. Its poor armor protection led crews to attempt improvised solutions, such as placing sand-bags and logs on the glacis plate as seen here on an M5A1 of the 2nd Armored Division in Beggendorf, Germany, on 16 November 1944 during the fighting for the Siegfried Line. This tank is fitted with the T36E7 Burgess-Norton steel track. ***(US Army MHI)***



PRE-WAR TANK AND COMBAT CAR PRODUCTION*

	1936	1937	1938	1939	1940	Total
M1 Combat Car	33	26	30			89
M1A1 Combat Car			24			24
M2 Combat Car					34	34
M2A1 Light Tank	9					9
M2A2 Light Tank	10	152	74			236
M2A3 Light Tank				71		71
M2A4 Light Tank					325	325
Prototypes		2				2
Total	**52**	**180**	**128**	**71**	**359**	**790**

every respect as a fighting tank...The light tank is being used for working with the infantry. We subject it to direct fire just as little as we can, for it is realized that the armor will not turn the German fire or the 37mm gun damage the German tanks or SP guns.' In total, the US Army lost 777 M5A1 light tanks in combat during the campaign in north-west Europe, and 424 in Italy.

The most common use of the Stuart tank in British and Commonwealth formations was in the reconnaissance troops of armored units, which had 11 Stuarts each. Although most British units in north-west Europe used the Stuart V (M3A3), some recce troops still had the older Stuart III (M3A1) or the Stuart VI (M5A1). Polish and Czech armored units followed British organizational practice, and their vehicles were provided from British Lend-Lease sources. The Poles received about 110-130

In British service, the M5A1 was known as the Stuart VI and was used along with the Stuart III (M3A1) and Stuart V (M3A3) as a reconnaissance vehicle in the 1944-5 fighting in north-west Europe. It was also used by forces supplied from British Lend-Lease allotments including Canadian, Polish and Czech units. This well-camouflaged example from the 1st Anti-tank Regiment of the 1st Polish Armored Division passes by an Achilles tank destroyer in Germany in the spring of 1945. ***(Sikorski Institute)***

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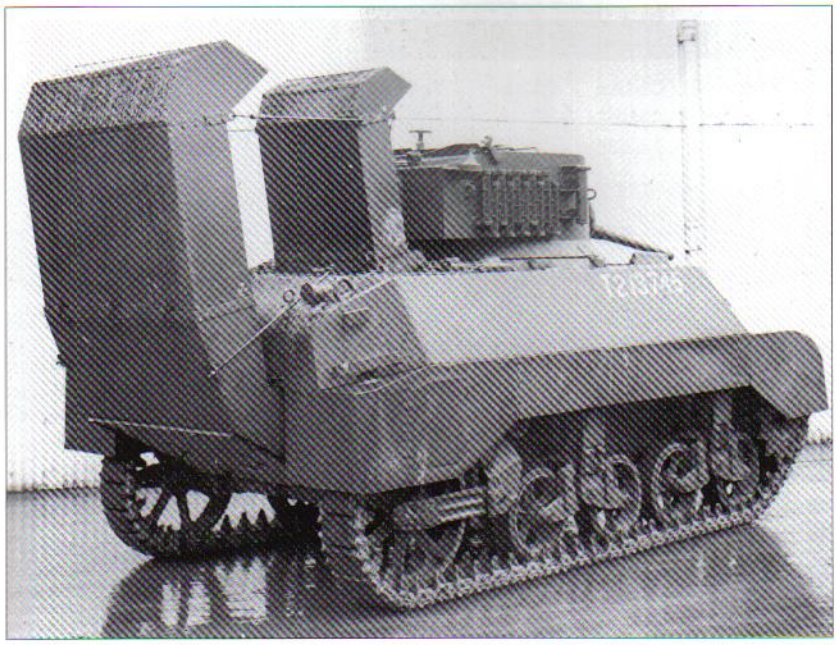


Stuarts of various versions for the 1st Armored Division in north-west Europe and the 2nd Armored Division in Italy. The Czechoslovak Independent Armored Brigade operated about 30 M5A1 light tanks. Besides their use as reconnaissance vehicles, turretless Stuarts were widely used as armored ammunition carriers to supply forward tank units. For example, of the 259 Stuart III and Stuart VI tanks in service with the Canadian 1st Army in north-west Europe at the end of the war, 109 (42 percent) were ammo carriers.

Britain was one of the main recipients of the M3A3 light tank, where it was known as the Stuart V. By this stage of the war, it was used primarily as a reconnaissance tank. Prior to the Normandy landings, they were fitted with deep wading trunks for amphibious operations as seen here. ***(The Tank Museum)***

Stuarts in the Mediterranean theater

Besides operations in north-west Europe, Stuarts remained in widespread use in the Mediterranean theater with British and American forces in 1944-5. Since it was mainly intended for reconnaissance, some British recce troops modified the Stuart by removing its turret, a practice first started in the Western Desert. The lighter weight made the vehicle faster and more nimble than turreted Stuarts, and these features were sometimes judged more valuable than the firepower of the 37mm gun. These were dubbed 'Stuart Recces' and varied considerably in detail. Stuarts were also used as ammo carriers in this theater.

In 1944, Britain assisted in the formation of the Yugoslav 1st Armored Brigade, which was equipped with a single M3A1 Stuart III and 56 M3A3 Stuart V light tanks. They were landed on the Adriatic coast, and took part in the liberation of Yugoslavia. Even the Yugoslavs found the firepower of the Stuart to be deficient, and upgunned some of their tanks with captured German 75mm PaK 40 anti-tank guns, or quadruple 20mm FlaK 38 anti-aircraft guns.

WARTIME STUART LIGHT TANK PRODUCTION

	1941	1942	1943	1944	Total
M2A4	40	10			**50**
M3 (diesel)	479	802	4		**1,285**
M3 (gasoline)	2,072	2,454			**4,526**
M3A1 (diesel)		211			**211**
M3A1 (gasoline)		4,370	40	4,410	**8,820**
M3A3		2	3,425		**3,427**
M5		4,148			**4,148**
M5A1		784	4,063	1,963	**6,810**
M8 HMC		373	1,330	75	**1,778**
Total	**2,591**	**13,154**	**8,862**	**2,038**	**26,645**

STUART LEND-LEASE SHIPMENTS

	UK	USSR	France	China	Other	Total
M2A4	36					36
M3	5,532	1,676*	307	536	497	8,548
M5	1,421	5	226			1,652
M8 HMC			174			174
Total	**6,989**	**1,681**	**707**	**536**	**497**	10,410

*of which 443 were lost at sea

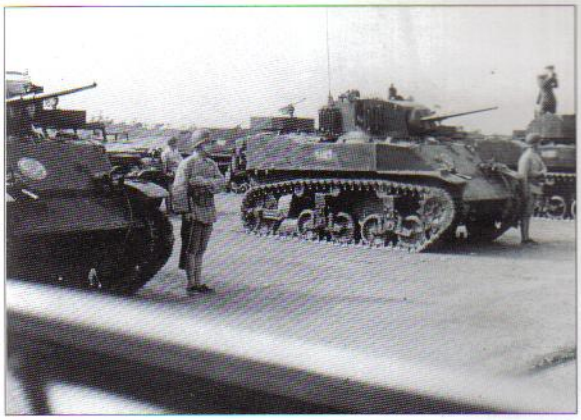
Post-war use of the Stuart

The US Army was under few illusions about the M5A1 light tank, and in the post-war years quickly retired it from service. It disappeared from British service nearly as fast. A small number of M5A1 light tanks remained in American service for a few years after the war. The 1/7th Marines stationed at Chim-won-tal in China converted four of their M5A1 light tanks by removing the turret and part of the superstructure, and mounting 105mm howitzers in them as improvised fire support vehicles. Although obsolete by most standards, Stuarts were turned over to some of the more poorly equipped European armies in the late 1940s, including Belgium, the Netherlands, Italy, Turkey, and Greece.

France continued to operate the M3A3 and M5A1 light tanks after the war until their own AMX-13 light tank became available in the 1950s. During the reoccupation of Indochina, a platoon of M5A1 light tanks from the 501er RCC was sent to support French army operations. By 1950, the M5A1 light tanks in Indochina were replaced by more modern vehicles, though some units such as Foreign Legion cavalry units continued to use the M5A1 in dwindling numbers.

The Nationalist Kuomintang forces continued to use the M3A3 light tanks provided to them during the fighting for Burma in 1944–5. These light tanks formed the basis of a number of small Nationalist armored units taking part

Although increasingly obsolete in Europe, the M3 light tank was a formidable weapon by Latin American standards. The M3 light tank was supplied in significant numbers to armies in South America, the first and largest recipient being Brazil, seen here with its national insignia on the turret side. These vehicles remained the backbone of many Latin American armies until recent years.



in the Chinese Civil War, 1946–9. Kuomintang armored forces had some local successes, such as the defeat of an amphibious assault at Chinmen in 1949 by a small unit of M3A3 light tanks. But there were never enough tanks available to have any serious impact on the fighting. After the Nationalist defeat on the mainland, many of these tanks were captured by Mao's Communist forces. They were used for a short time in the early 1950s by the People's Liberation Army, but a lack of spare parts and the arrival of more modern Soviet tanks in 1950 led to their retirement. The Republic of China on Taiwan later received some M5A1 light tanks for its new armored force.

The M5A1 light tank remained in service in Asia for much of the 1950s, such as these vehicles with the Republic of China Army on Taiwan in January 1952. ***(US Army)***

In spite of its close association with desert warfare, the Stuart saw little service in the Middle East after the war. Egypt apparently had small numbers in service, as did several other of the newly independent nations in the region such as Iraq. However, by the time the major wars started in 1956, they had already been retired.

The Stuart remained in Indian service for many years after the war, the Stuart VI (M5A1) until 1958 and the Stuart V (M3A3) until 1965. The Indian Stuarts were active during the turmoil with Pakistan surrounding Partition in the late 1940s, but they had been retired before the outbreak of the India–Pakistan war in 1965.

Although not widely used in combat, the Stuart light tank formed the basis for many of the small armored forces in Latin America from the late 1940s until the 1960s. US shipments of M3 and M3A1 light tanks to Latin America during the Second World War totaled more than 500 to Brazil (427 M3); Chile (30 M3A1); Colombia (12 M3A1); Cuba (12 M3A1); Ecuador (42 M3A1); El Salvador (six M3A1); Mexico (four M3A1). Some of the smaller armies kept these vehicles in service into the 1990s, and Brazil attempted to rebuild their Stuarts in the 1980s to extend their life.

Although no longer in use as a tank, the British Army continued to use the Stuart in secondary roles after the war: this Stuart VI (M5A1) is used as an artillery tractor for a 17-pdr. anti-tank gun. ***(The Tank Museum)***

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THE PLATES

A: Stuart I, 8th King's Royal Irish Hussars, 4th Armd. Bde., 7th Armd. Div., Operation *Crusader*, November 1941

Stuarts at the time of Operation Crusader were still finished in the Caunter scheme, a disruptive pattern developed by a former 4th Armoured Brigade commander, Brigadier J. A. L. Caunter. Like the dazzle painting of First World War warships, the pattern was an attempt to confuse the enemy regarding range, and direction of travel. This scheme has seldom been accurately depicted, and the first complete details were published in 1997–8 in a series of articles by Mike Starmer in the journal *Tankette*. The base color of the pattern was BSC No. 64 Portland Stone. The two other colors were BSC No. 28 Silver Grey and BSC No. 34 Slate, although the 'New Service Color', Khaki Green 3, was given as an alternative to Slate.

A major tactical problem in the desert was vehicle identification, and prior to Operation *Crusader*, a white/red/white identity marking, inspired by the First World War tank marking, was adopted for British tanks. Colored pennants were also used on the aerials or special poles for the same purpose, in this case in yellow. This regiment had a tradition of using famous racing names for identification. Headquarters used race-horse names beginning with H, such as the commander's 'Hurry On', with the squadrons using names starting with the company letter. B Squadron used the names of hounds, such as Boxer, Beacon, and Bellman as seen here. The B Squadron square tactical sign was in yellow, as is the vehicle name, though the square has been partly covered over by the ID bands. The vehicle registration number was white on a rectangle of the original vehicle color, American olive drab, and was generally in the T.27950 to T.28120 range. The famous divisional insignia, the Desert Rat, was carried on the front and rear.

The M3 light tank underwent continual incremental upgrades during its production. The new D39273 rolled homogenous turret was introduced from October 1941. This round turret used Protectoscopes, a type of armored viewing device for the turret. This is from the standard production batch, which had four viewing ports added to the cupola. The 2nd Armored Division at Fort Benning was the first unit to receive this type in large numbers, seen here on 20 February 1942. *(US Army MHI)*

B: M1A1 Light Tank, 2nd Armd. Div., Fort Benning, Georgia, 1941

Brig. Gen. George S. Patton was appointed to command the 2nd Armored Brigade at Fort Knox in July 1940 following the formation of the new Armored Force. He employed this light tank (formerly M2 Combat Car) as his command vehicle during field maneuvers. While brigade commander, his turret was painted with three stripes: red, white, and blue which, besides being the national colors, were also those used by the 1st, 2nd, and 3rd tank battalions, and worn as bands around the base of the turret as tactical markings. When Patton was later asigned to command the entire 2nd Armored Division a yellow band was added to signify the other units composing the division. Nicknamed the 'Green Hornet' by his troops after his notorious

The M5A1 light tank lingered on in service after the Second World War when the US supplied a number of the smaller armies with tanks under the Military Assistance Program (MAP). This is an M5A1 light tank of the post-war Italian army parading in Rome. ***(US National Archives)***

proposal for a new tanker's uniform, Patton delighted in racing around Fort Knox in his tank with the siren wailing.

Patton's tank was originally painted in the pre-war F.S.14064 olive drab which, because of its gloss finish, tended to have a darker appearance than the lusterless olive drab used on tactical vehicles. The Adjutant-General's office authorized the painting of all tactical vehicles in F.S. 34087 lusterless olive drab No. 9 on 2 December 1940 and all tanks provided from the fiscal year 1941 budget were issued in this color. Judging from the use of blue drab for the vehicle registration number (USA W-40258), the tank had been repainted in lusterless olive drab. The use of lusterless blue drab for registration numbers only became official in a November 1941 War Department regulation, but the practice was already underway earlier in 1941.

The national insignia resembled that used by the US Army Air Force, but the colors were reversed with the outer circle being red, the star white and the inner circle in the center of the star in blue. The red flag with two white stars indicate Patton's rank at the time and follow the standard pattern for marking staff cars. The metal flag on the left fender is red over yellow and in the center is the divisional insignia of the 2nd Armored Division.

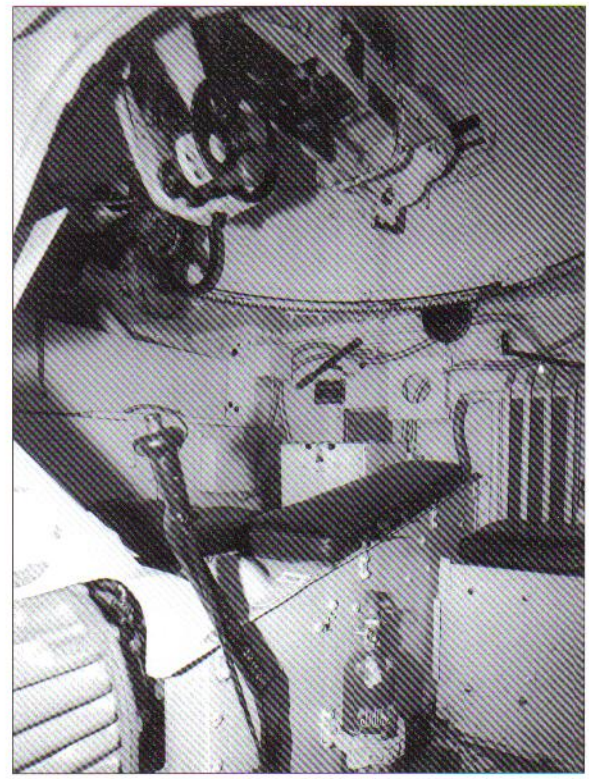
C1: M3 Light Tank, Co. B, 192nd Tank Bn., Philippines, December 1941

The US Army light tanks in the Philippines were painted in a very simple fashion and carried few markings, having only recently been delivered from the factory. At this time, the US national insignia was not commonly painted on tanks. This tank carried the name 'Helen', probably the wife or girlfriend of the commander. The tank was finished in the standard scheme of the time, overall lusterless olive drab No. 9, with blue drab registration numbers. The specific registration numbers of this tank are not known, indeed, the whole point of the use of blue drab paint was to make the registration number invisible on black and white photographic film. A representative number has been used.

C2: M2A4 Light Tank, Co. A, 1st Marine Tank Bn., Guadalcanal, September 1942

In August 1942, Co. A, 1st Marine Tank Battalion disembarked on Guadalcanal with its M2A4 and M3 light tanks. The markings pattern of the USMC units on Guadalcanal have not been found in the unit records, and did not follow the standardized marine UNIS (Unit Numerical Identification System) used for the remainder of the war. Most light tanks had a band painted around the turret, either in white or yellow, though other colors were apparently used. This was probably intended for national identification to distinguish the Marine tanks from Japanese

This is a view of the interior of a late production M3 light tank taken from the driver's station and looking towards the rear. The 37mm gun is evident in the upper left of the photo. The engine powertrain housing is evident in the lower center of the photo, along with two of the ammunition bins. The covers of the bins were padded, as they were used as seats for the turret crew during transit. This photo was taken inside a restored M3 light tank obtained from Brazil, and exhibited at the Patton Museum at Fort Knox. ***(S. Zaloga)***



armor, as the Marines did not use the white star as regularly as the US Army as a national identity marking. White stars were later crudely hand-painted on the tanks for clearer identity by US units as seen here. The platoon was identified by a geometric shape (circle, diamond, square), while the company was identified by the number inside the geometric shape (1 = HQ, 2 = Co. A, 3 = Co. B, etc.). The unit also used a temporary system of vehicle registration numbers, usually hastily painted in white on the hull side. Marine tanks were painted in the same lusterless olive drab as the army.

Plate D
M3, 1st Bn., 1st Armd. Regt., 1st Armd. Div., Tunisia, November 1942
See cutaway for details.

E: M5 Light Tank, Co. C, 70th Tank Bn. (L), Oran, Morocco, January 1943
The 70th Tank Battalion (Light) was among the first US Army units to use the M5 in combat, taking part in the capture of the Casablanca airport in November 1942. The national insignia on vehicles taking part in the *Torch* landings was unusually prominent, in hopes of convincing the Vichy French forces not to fire. Similar markings were carried on M5 light tanks of the 756th Tank Battalion (Light) which also took part in the Casablanca landings. The use of a large yellow star, or a white star as an alternative, was authorized by Operational Memo No. 9 of 25 September 1942, and reinforced by a second ops memo on 1 October 1942. The use of yellow stars was officially rescinded on 5 December 1942 after it was found that it was easily obscured by dust. However, yellow stars remained in use for much of the Tunisian operation. The white star on the hull front is particularly excessive in size. On the hull side is a smaller star in yellow along with the American flag. The official air identification marking for this operation was a white star within a blue circle, authorized by an ops memo on 31 August 1942 for all US Army tactical vehicles for Operation *Torch* and carried on the top surface. The vehicle unit codes consist of the normal style on the lower bow, 70^ C-16, and shipping codes on the front side (5048-16). The vehicle registration number is in the usual blue drab and the tank is finished in standard lusterless olive drab.

F: M3A3 (Stuart V) Light Tank, I Tenkovski Brigada, Yugoslavia, 1945
Britain assisted the Titoist partisan forces by helping to equip and form a tank brigade in Italy in 1944, which was landed on the Dalmatian coast of Yugoslavia in early November 1944. The brigade later improved the firepower of some of its Stuarts by substituting captured German weapons, such as the quadruple 20mm FlaK 38 automatic cannon seen here, or the PaK 40 75mm anti-tank gun, in place of the usual turret. These vehicles were finished in the usual olive drab, but the Yugoslavs often camouflage-painted them as here with a pattern of sand paint. The Yugoslav insignia was carried on the hull side consisting of the national tricolor in red/white/blue, with a red star in the center white band.

G1: M5A1, 601st Tank Destroyer Bn., Volturno River, Italy, October 1943
The M5A1 light tank sometimes ended up in expedient roles, as here where it is serving in a tank destroyer battalion in lieu of the

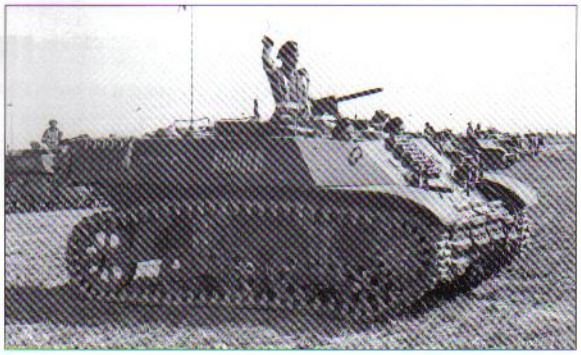
The M5A1 light tank was used in the Pacific theater by both US Army and Marine tank units. This late production M5A1 of Co. D, 706th Tank Battalion, leads a motorized column from the 40th Infantry Division shortly after the landings on Negros Island in the Philippines on 29 March 1945. The late production version of the M5A1 light tank incorporated a number of changes including the addition of a new stowage bin on the hull rear, and the new D60490 folding pintle mount for the machine-gun on the turret side in place of the earlier M20 elevator bracket mount. ***(US Army)***

The M3A3 light tank was an attempt to modernize the hull design of the M3 light tank series. By the time it became available in 1943, the US Army decided to standardize on the M5 light tank series. So all M3A3 production was earmarked for Lend-Lease export. This is an M3A3 light tank of the 3rd Company, 1st Battalion, Chinese 1st Provisional Tank Group, which was raised in India in 1944 and saw fighting in the Burma theater in 1944–5. ***(US National Archives)***

normal M8 armored car. This vehicle carries markings typical of the Italian campaign. The white star in a circle was authorized for the invasion of Sicily and was often used afterwards. The 601st Tank Destroyer Battalion used its own tactical insignia as seen on the side of this tank, a yellow square with a red Y and the company letter in red in the lower left corner.

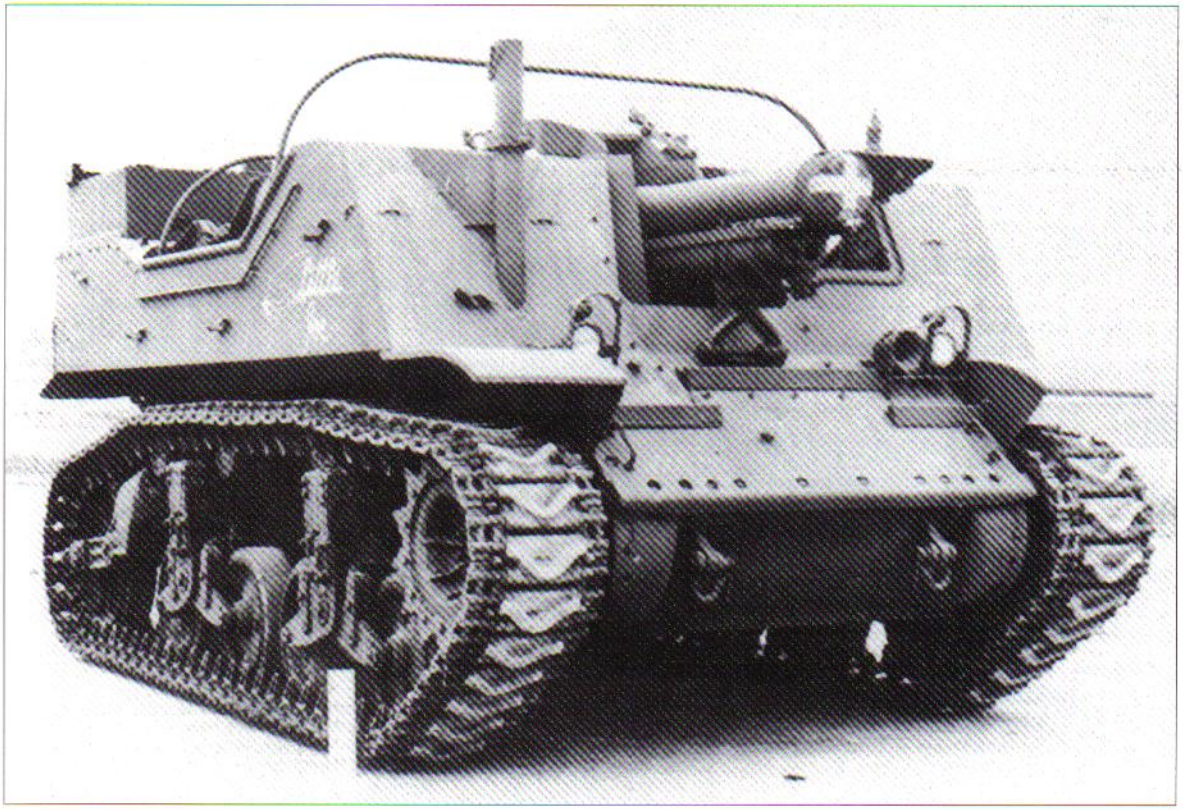
G2: M8 Howitzer Motor Carriage, Régiment de Marche du Tchad, 2e Division Blindée, France, 1944

The Régiment de Marche du Tchad was the French 2nd Armored Division's mechanized infantry formation, and so had two support companies with M8 howitzer motor carriages. The division was organized along American lines, but used its own distinctive set of markings. The most prominent was the Cross of Lorraine imposed over a map of France on a medium blue circle as seen here on the front side of the vehicle. This was accompanied by the French tricolor outlined in white on the side and sometimes on the front as well. The division made a practice of naming their armored vehicles. In the case of the 1er Compagnie d'accompagnement (1st Support Company) the names in the 1st group were Pantagruel and Picrocole (as seen here); in the 2nd Group were Grandgousier and Panurge, and in the 3rd Group were Gargantua and Jean des Entommeurs. The names were painted in white or yellow on the hull sides, yellow in the case of Picrocole seen here. The 2nd Armored Division had an elaborate set of tactical markings based using a letter in the center for the regiment, with small bars around it indicating sub-formations. In the case of RMT here, the letter was B, and the 1st Support Company would have a horizontal bar above this. However, this unit did not always use this insignia, and it is not present here.



In the Italian theater, many British and Commonwealth units removed the turrets from their Stuart V tanks, since they were primarily intended for scouting. The Polish 2nd Armored Division in Italy, which was equipped from British sources, followed suit. This is a Stuart Recce named 'Kobra' of the HQ squadron of the 1st Krechowiecki Lancer Regiment in Italy in 1945.
(Sikorski Institute)

There were a number of attempts to develop a self-propelled gun derivative of the M3 and M5 light tanks to provide direct fire support. The T82 105mm howitzer motor carriage was canceled in 1945 when it became apparent that the war would end before it would be available.
(Patton Museum)



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CAMPAIGN
Accounts of history's greatest conflicts, detailing the command strategies, tactics, movements and actions of the opposing forces throughout the crucial stages of each campaign. Full-colour battle scenes, 3-dimensional 'bird's-eye views', photographs and battle maps guide the reader through each engagement from its origins to its conclusion.

ORDER OF BATTLE
The greatest battles in history, featuring unit-by-unit examinations of the troops and their movements as well as analysis of the commanders' original objectives and actual achievements. Colour maps including a large fold-out base map, organisational diagrams and photographs help the reader to trace the course of the fighting in unprecedented detail.

WARRIOR
Insights into the daily lives of history's fighting men and women, past and present, detailing their motivation, training, tactics, weaponry and experiences. Meticulously researched narrative and full-colour artwork, photographs, and scenes of battle and daily life provide detailed accounts of the experiences of combatants through the ages.

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Portraits of the elite pilots of the 20th century's major air campaigns, including unique interviews with surviving aces. Unit listings, scale plans and full-colour artwork combine with the best archival photography available to provide a detailed insight into the experience of war in the air.

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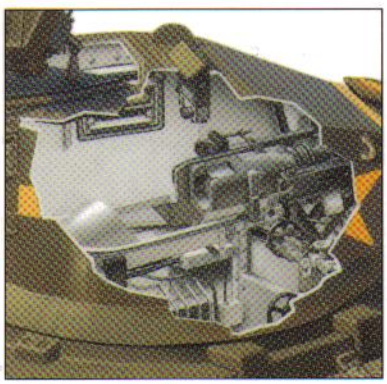
Sandini

The design, development, operation and history of the machinery of warfare through the ages.

Full color artwork

Unrivaled detail



Cutaway artwork

Photographs

M3 & M5 Stuart Light Tank 1940–45

The M3 and M5 family of light tanks were the culmination of American tank development in the 1930s. By the time of the outbreak of World War II, they were approaching obsolescence, as tank forces in Europe were shifting from light to medium tanks as the main element of their armored forces. First entering combat in the fall of 1941 in the Western Desert with the British Army, the Stuart quickly proved its inadequacies. The M3 and M5 light tanks proved more suitable in the Pacific theater than in Europe, and fought successfully in many of the major battles including Guadalcanal, Tarawa and Peleliu. This title narrates the distinctive and unusual history of this fighting vehicle.

OSPREY PUBLISHING

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ISBN 1-85532-911-5

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